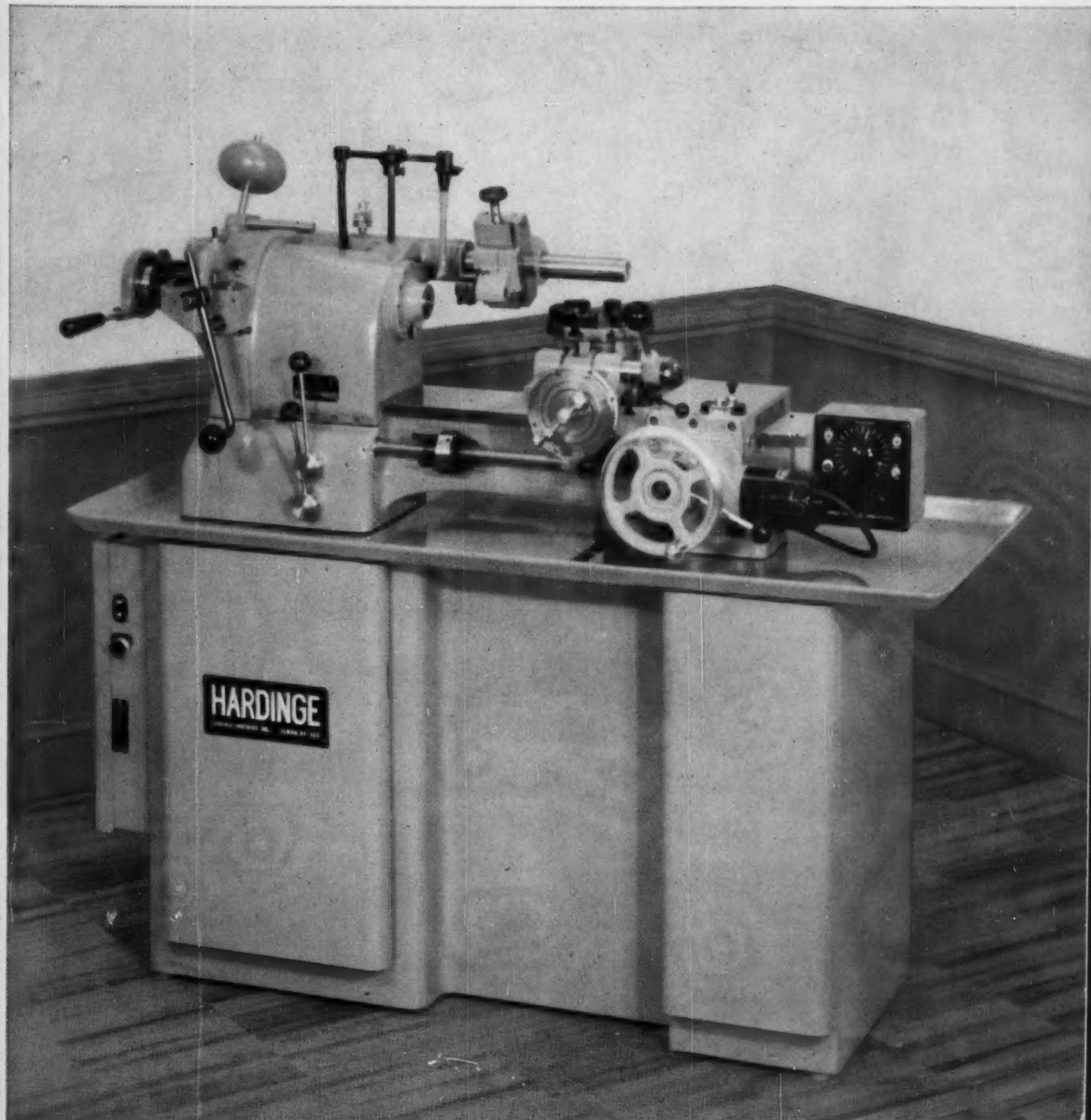
DECEMBER 1955—SIXTY-SECOND YEAR

MACHINERY



Closer Tolerances Increase Demand

for the HARDINGE HCT Precision Chucking Machine

SEE PAGE 140

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MACHINERY

Volume 62 DECEMBER, 1955 NUMBER 4

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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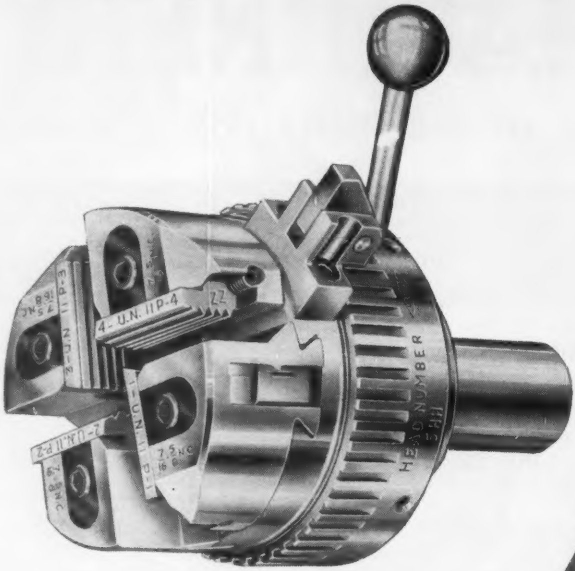
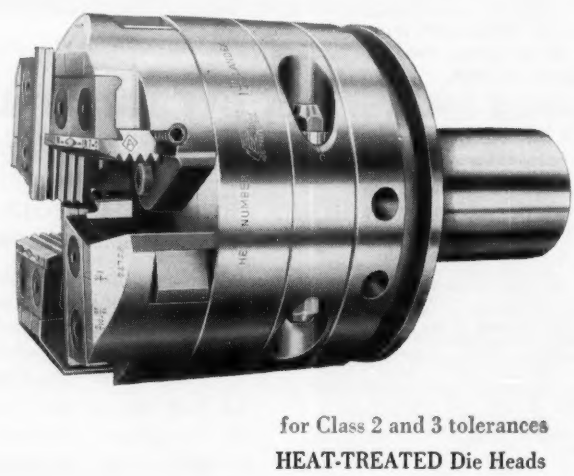


for Class 4 and 7 tolerances
HARDENED-AND-GROUND Die Heads

2

..... maximum



for Class 2 and 3 tolerances
HEAT-TREATED Die Heads

styles of LANDIS Die Heads

PRECISION or ECONOMY

"Threading Efficiency" requires the selection of the proper die head for the job to be done, and is the essence of LANDIS design. To ensure that you may use the most efficient threading tool, LANDIS manufactures Die Heads in two basic styles:

HARDENED-AND-GROUND HEADS should be used where a high degree of thread-cutting accuracy is required. Their fundamental design and the inherent qualities of specially selected and hardened materials provide the maximum rigidity necessary for threading to Class 4 and Class 7 tolerances.

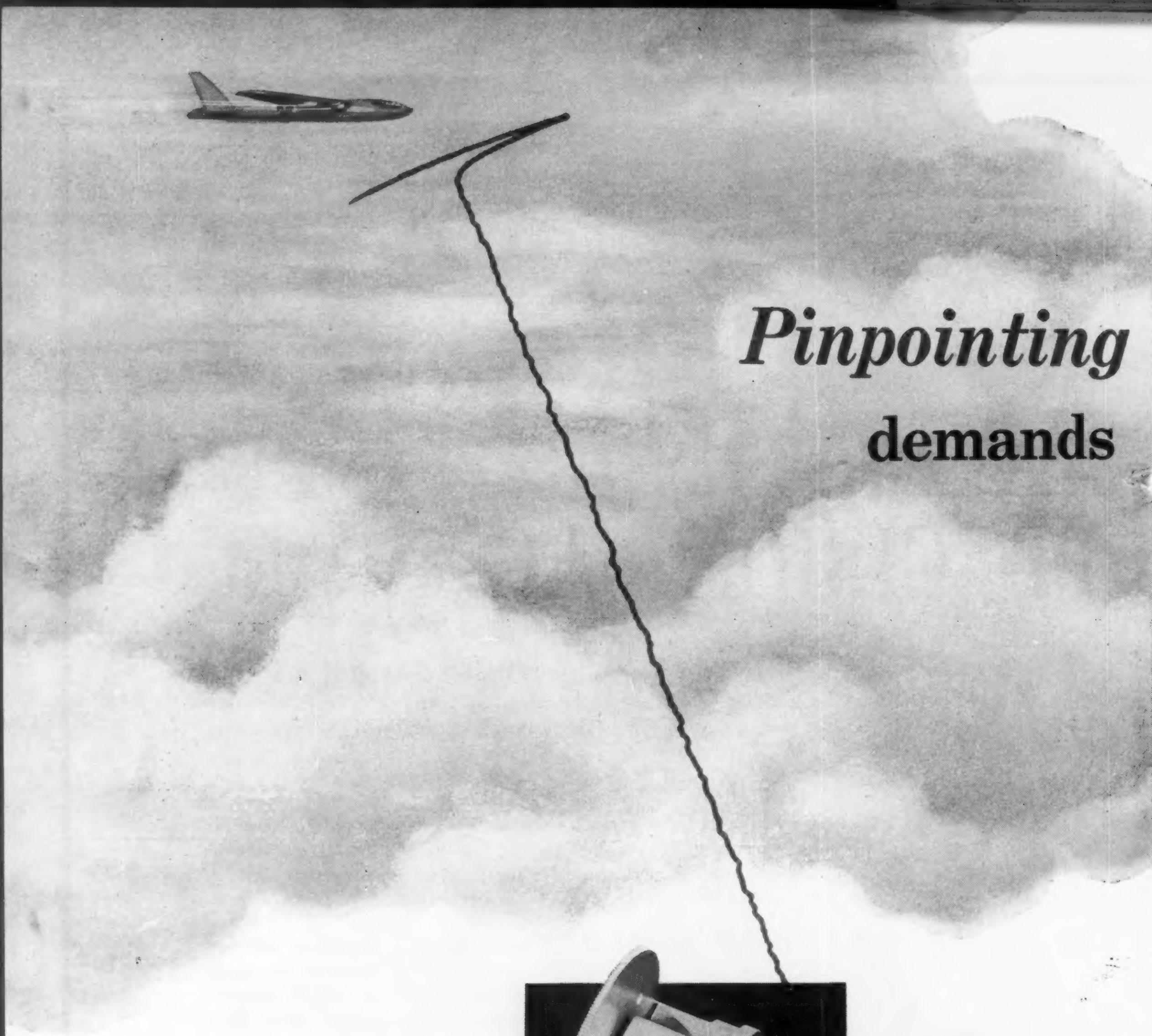
HEAT-TREATED HEADS are designed for the utmost economy when doing commercial threading, and will produce threads to Class 2 and 3 fits. The initial cost is small and rugged construction ensures trouble-free operation and few repairs. Wide range coverage requires minimum tool inventories, and along with the use of LANDIS Tangential Chasers allows maximum output per dollar of tool cost.

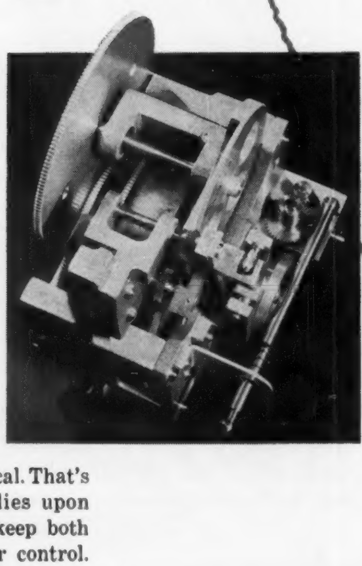
LANDIS Tangential Chasers are an important factor both in the economy and precision of these basic head styles. These chasers may be replaced or reground singly, will thread all diameters of the same pitch and form, and can be used for 80% of their original length. Their basic design minimizes stress and distortion, and allows either style of die head to produce threads of the accuracy for which it is recommended.

LANDIS manufactures more than 100 sizes and styles of standard and special Die Heads for use on threading machines, turret lathes, tapping machines and bar automatics. Let us suggest the Head most suitable for *your* needs—send specifications and ask for Bulletins F-80 and F-90.

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

445-C





invisible targets
HIGH PRECISION GEARS

Altitude: 40,000 feet! Ceiling: zero! The bombardier pushes a button... the automatic bomb director system goes into action... and another bull's eye is scored without even seeing the target!

The keynote of this amazing electro-mechanical mechanism, made by the Instrument and Systems Division, Norden-Ketay, is PRECISION. Because precision gears and gear trains play such a vital role, Norden-Ketay have built much of their production capacity around Fellows Equipment.

Fellows Precision Line offers a most efficient cost and quality control in the cutting, shaving and inspecting of fine-pitch gears. These machines and tools are fully integrated to provide a coordinated, balanced combination for close tolerance control in every step of gear production. The result: quality, economy and "unified" responsibility.

WRITE, WIRE or PHONE any Fellows Office for the information about the most recent developments in the Fellows line for fine pitch gears. If desired, they will give you all the facts about the Fellows Plan for Deferred Payment, too.

THE FELLOWS GEAR SHAPER COMPANY,
78 River Street, Springfield, Vermont.
Branch Offices: 319 Fisher Building, Detroit 2
5835 West North Avenue, Chicago 39
2206 Empire State Building, New York 1
6214 West Manchester Avenue, Los Angeles 45

Fellows *Gear Production Equipment*

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CINCINNATI DIAL TYPE MILLING MACHINES

The new Dial Types are bound to make a big hit in your shop . . . with the operator and foreman . . . with the methods engineer . . . with the new equipment analyst.

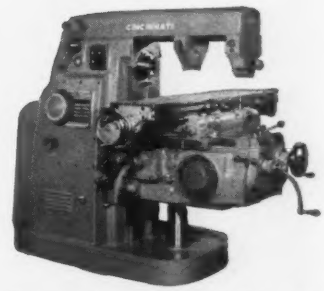
The new Dial Types are easier and safer than ever before to operate because of their dual push-button controls; complete safety from spinning hand cranks; large and conveniently located speed and feed dials.

The new Dial Types have the capacity to take on more work than ever before . . . higher ranges of speeds and feeds (up to 90" per minute feed rate); more than 50% increase in power; fully automatic table feed cycles if you want it; automatic backlash eliminator standard equipment.

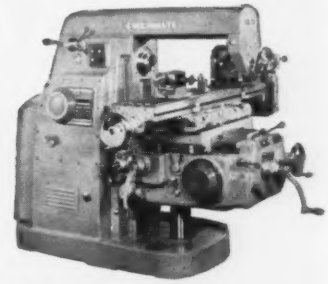
The new Dial Types will satisfy the most critical equipment analyst . . . built-in, completely protected electrical controls; feed drive motor, unit construction and cradle type mounting of main drive motor reduce maintenance expense; operators can utilize their energy more productively; big variety of work, including high production jobs, can be assigned to *the New Dial Types.*

Everywhere you look you'll find new Dial Type features of value in your shop. There are many, many more than outlined here. You will get a better idea from the new catalog. Write for your copy of publication No. M-1915.

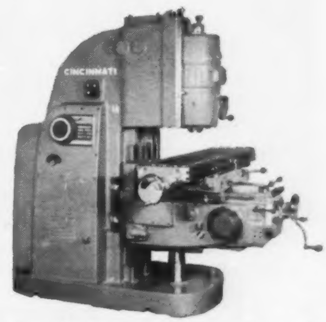
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



The New CINCINNATI No. 2 Plain Dial Type Milling Machine



The New CINCINNATI No. 2 Universal Dial Type Milling Machine



The New CINCINNATI No. 3 Vertical Dial Type Milling Machine

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

CINCINNATI

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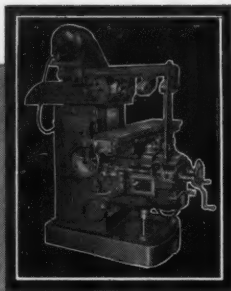

Why Buy Two When

ONE VAN NORMAN Ram Type Miller

Gives You the Workability of Two Single-Purpose Machines

Increases Your Production . . . Cuts Your Investment Costs!

Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

Lease and Conditional Sales Contracts not available to Export

VAN NORMAN

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

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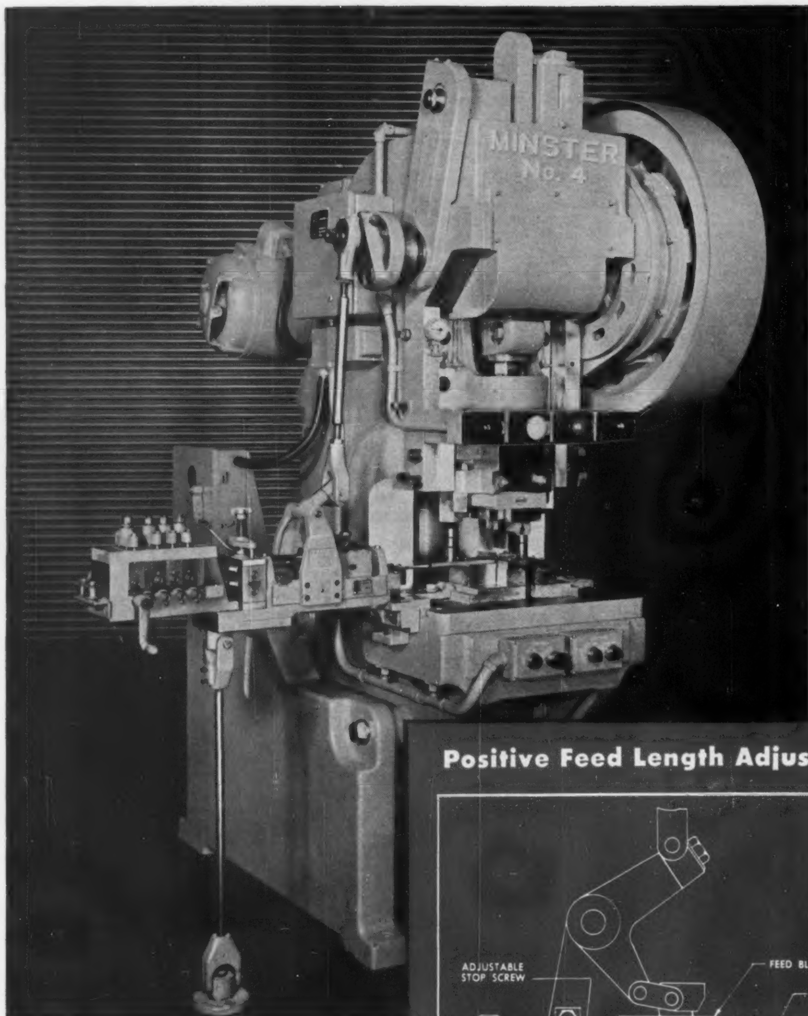
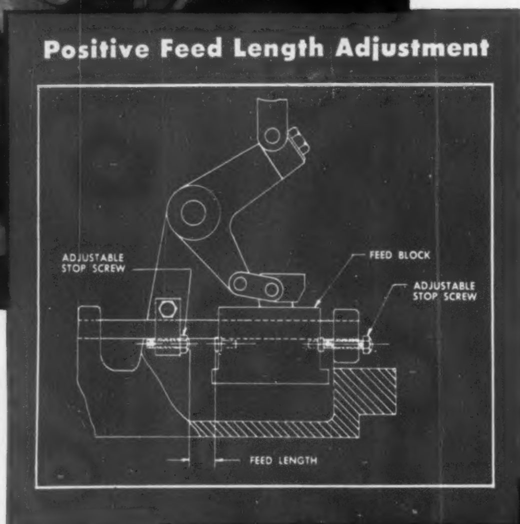
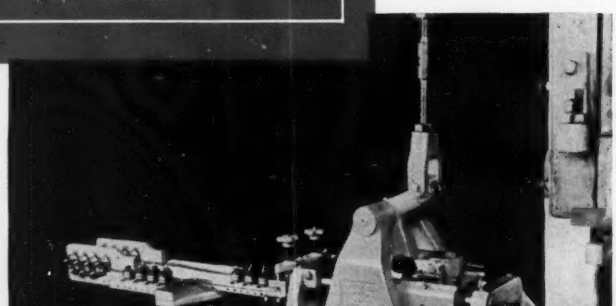


The photo at the left shows an SF-1 U. S. Slide Feed with SS-07 U. S. Plain Stock Straightener (7-roll type) mounted on a No. 4 Minster Press which is equipped with an air clutch and variable speed drive.



The drawing at the right shows how feed length is controlled between positive adjustable stops on the U. S. Slide Feed. This feature assures controlled accuracy of feed length—an especially important factor in progressive die operations.

The illustrations at the right show three other setups using U. S. Slide Feeds, U. S. Stock Reels, U. S. Coil Cradles, and other U. S. Automatic Press Room Equipment.



Worth Looking At!

Kearney & Trecker's

NEW RAM HEAD

plain and universal milling machines

KEARNEY & TRECKER'S new line of Ram Head milling machines combines a conventional horizontal spindle and a self-contained motorized sliding ram. As a result, horizontal and vertical spindles can be run separately and simultaneously.

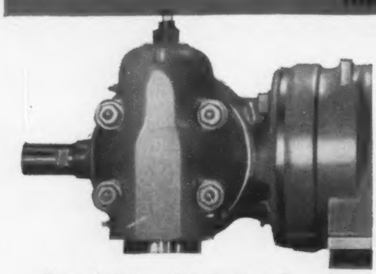
The Ram Head machines are available with a choice of three heads — Universal, Vertical and Quill types which can be rotated through 360°. You can perform vertical, horizontal and angular milling on one machine *in a single setup.*

Ram Head machines are highly versatile and exceptionally economical for general purpose production milling. They are built in Model CH, CK and CSM designs with 69 different machines in sizes from No. 2 to No. 4 in both plain and universal styles. Machines may be equipped with either Standard Directional Table Control, or Mono-Lever and Automatic Cycle Table Control.

To afford greater versatility with minimum maintenance, the Ram Head is individually motor-driven . . . has its own lubrication system and speed change mechanism. When used as a standard horizontal machine, the ram acts as a heavy-duty arbor support.

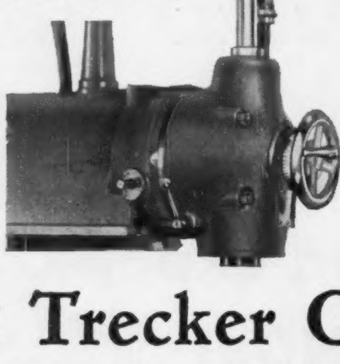
For the full story, contact your nearest Kearney & Trecker representative, or write: Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

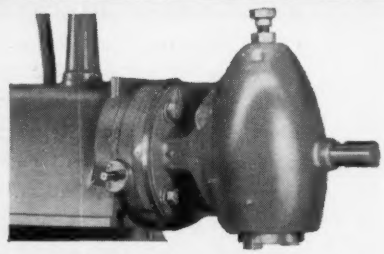
with choice of three types of heads



Type U Universal Swivel Head
Capable of numerous milling combinations, this Universal Swivel Head has two graduated bases at right angles to each other, both of which can be swiveled through 360 degrees. Head is rotated by worm and worm wheel with adjustment by hand crank.

Type Q Adjustable Quill Swivel Head
Spindle can be set at any angle through 360 degrees. This Ram Head has a 3½" hand-feed quill movement. In addition, four-position micrometer stop and dial indicator permit angular milling or boring operations of more than one height.

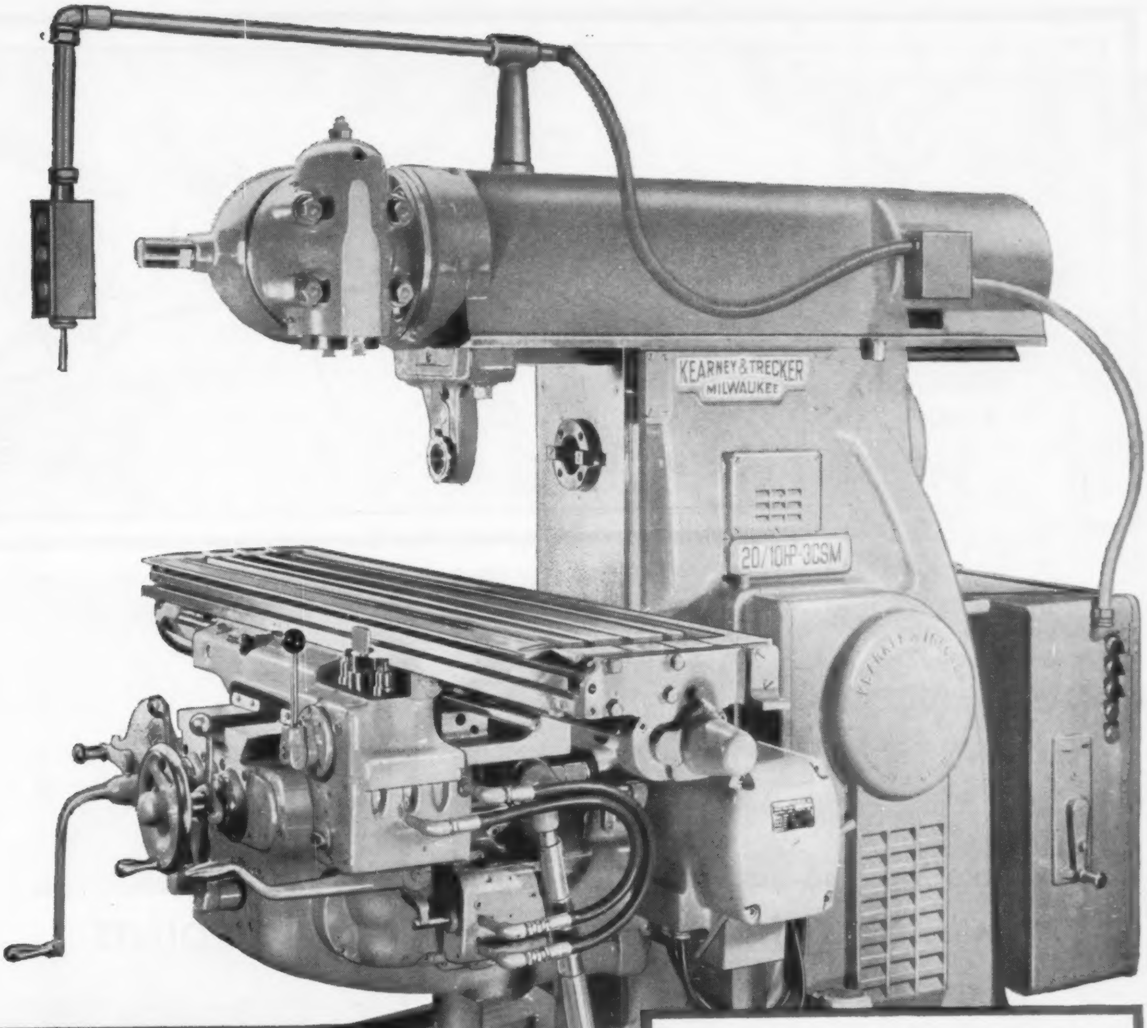




Type V Vertical Swivel Head
Especially adapted for vertical and angular milling operations. Spindle housing base of Vertical Swivel Head is graduated. Spindle can be set at any angle up to 360 degrees.

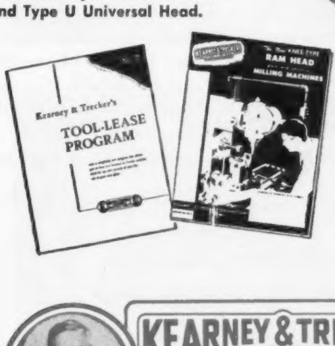
Kearney & Trecker Corporation

MILWAUKEE 14, WISCONSIN



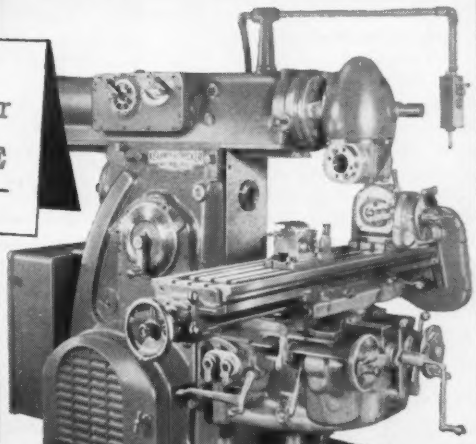
available for
TOOL-LEASE

20/10hp No. 3 Model CSM, Plain style Ram Head milling machine with Mono-Lever and Automatic Cycle Table Control and Type U Universal Head.



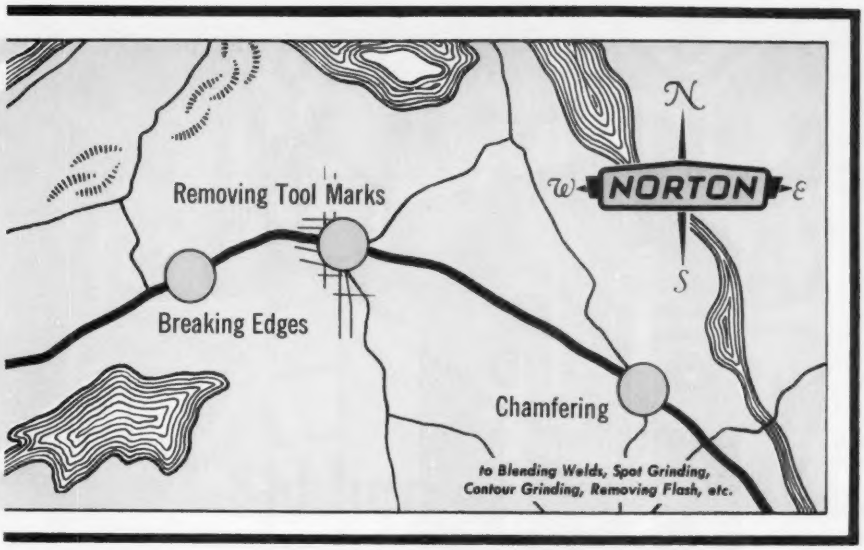
FREE CATALOGS!

Ask for catalog No. RH-10A for complete data on Ram Head plain and universal milling machines, and Tool-Lease bulletin, TL-10A. Also see our catalog in SWEET'S.

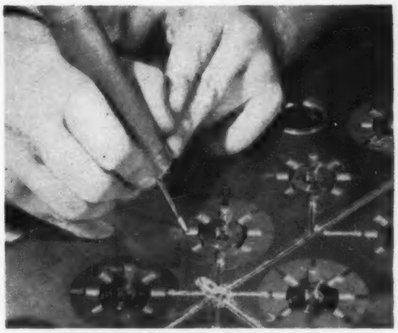


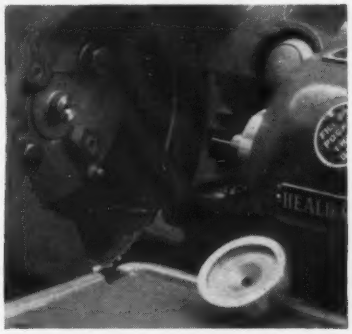
7½ hp No. 3 Model CH, Universal style Ram Head milling machine with standard Directional Table control and Type U Universal Head.

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS

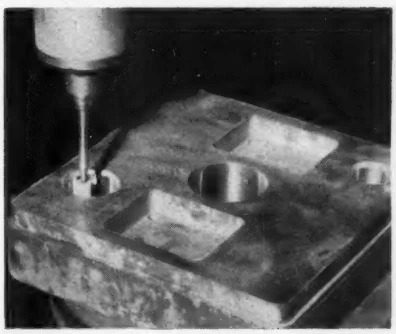


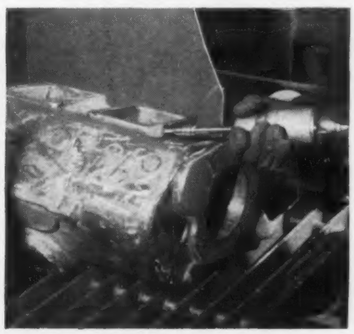

Smoothing a forging die


Finishing a plastic mold

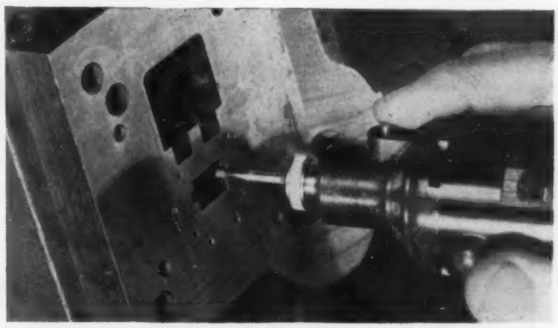

High speed internal grinding


Cleaning a cutting die


Jig grinding


Snagging a casting


Removing tool marks


Finishing a blanking die

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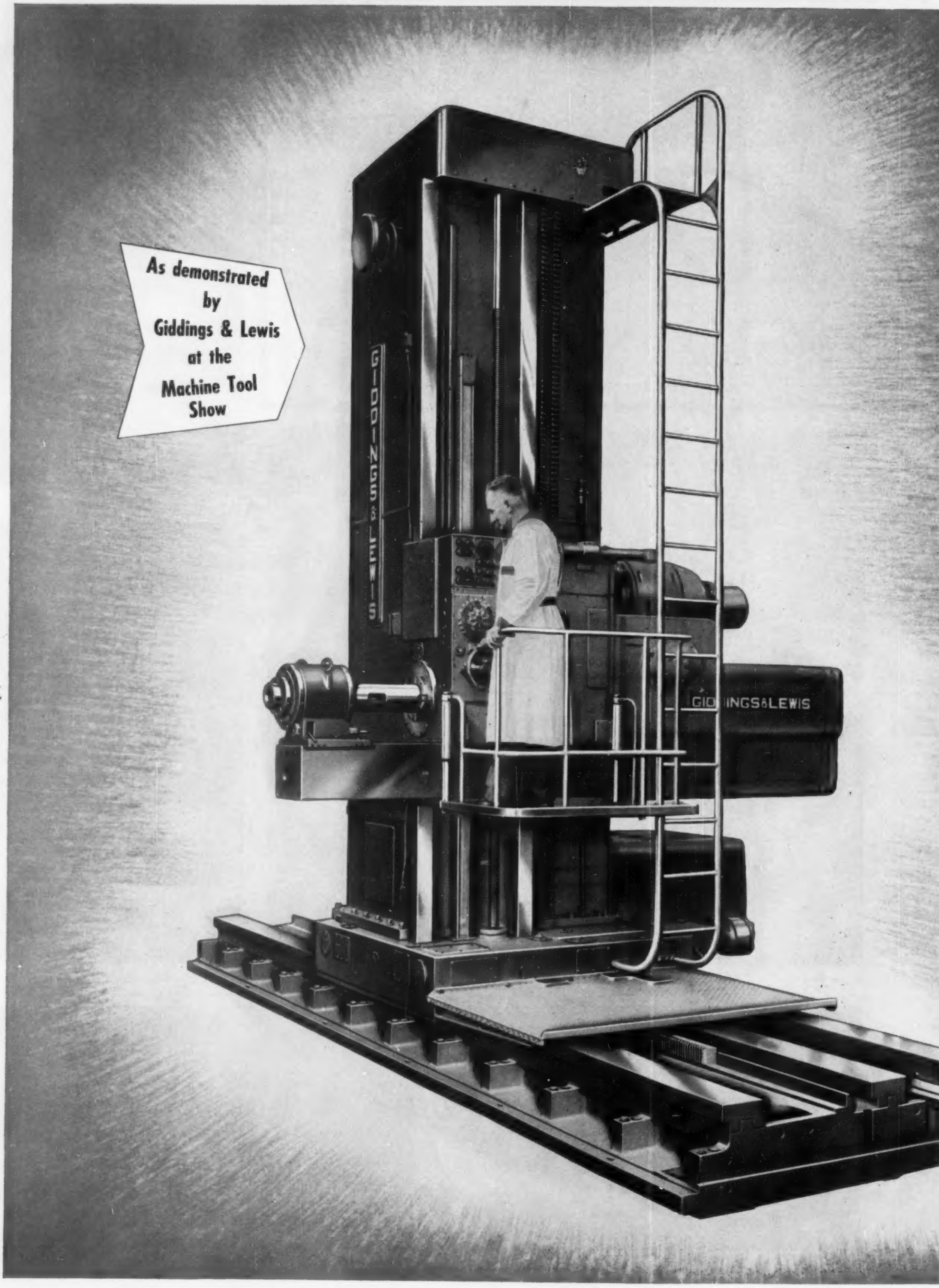
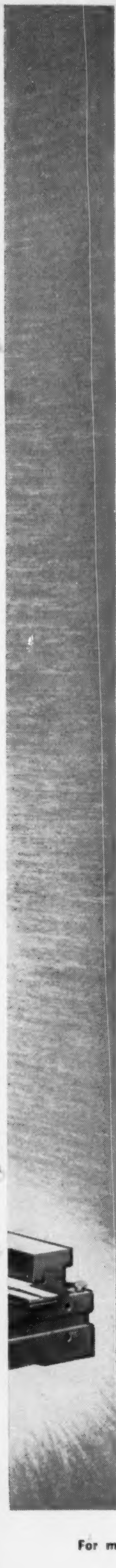

As demonstrated by Giddings & Lewis at the Machine Tool Show
GIDDINGS & LEWIS
GIDDINGS&LEWIS



THE MACHINE WE CALL THE AMAZON...

the ALL-NEW Giddings & Lewis 460-FUAR

HORIZONTAL BORING, DRILLING AND MILLING MACHINE

WHEN you talk machine tools with Giddings & Lewis, you expect "something extra." And if you saw the new 460-FUAR in operation at the Machine Tool Show — you know you get that "something extra" from this machine.

The 460-FUAR is the first in a new line of Giddings & Lewis machines — designated as the 40 Series line — that combines the ultimate in modern design and appearance with a new concept in machine capacity and simplicity of operation.

These new 40 Series Floor Type Horizontal Boring, Drilling and Milling machines are available with a variety of column working heights, runway lengths and with 5" and 6" diameter spindles. The spindle underarm support and a host of other capacity-increasing optional arrangements and accessories are yours for the ordering — according to your specific needs.

The machine's spindle is provided with 32 speeds (3-800 rpm) divided over four different ranges and with 18 feeds for each of the four. You can select various spindle movements with ease — accomplished by push-buttons and finger-tip dials through multiple-disc, hydraulically-actuated clutches. Feeds to the headstock and column are infinite within .5" to 120" per minute.

When equipped with an underarm spindle support (optional) you can perform machining operations beyond the normal range of the machine. It provides that extra-rigidity for the most efficient and accurate operation of angular milling attachments, continuous feed facing heads and face plate drives.

Another profit-making innovation is the special power hoist which enables the operator to handle heavy tools and attachments without waiting for an overhead crane. This feature speeds set-up and production time.

For more information on the outstanding design features of the new 40 Series line, be sure to see your nearest Giddings & Lewis representative. He'll be glad to help you solve your production problems and tell you what this versatile, economical new line of machines can do for you.

G&L HYPRO DAVIS

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

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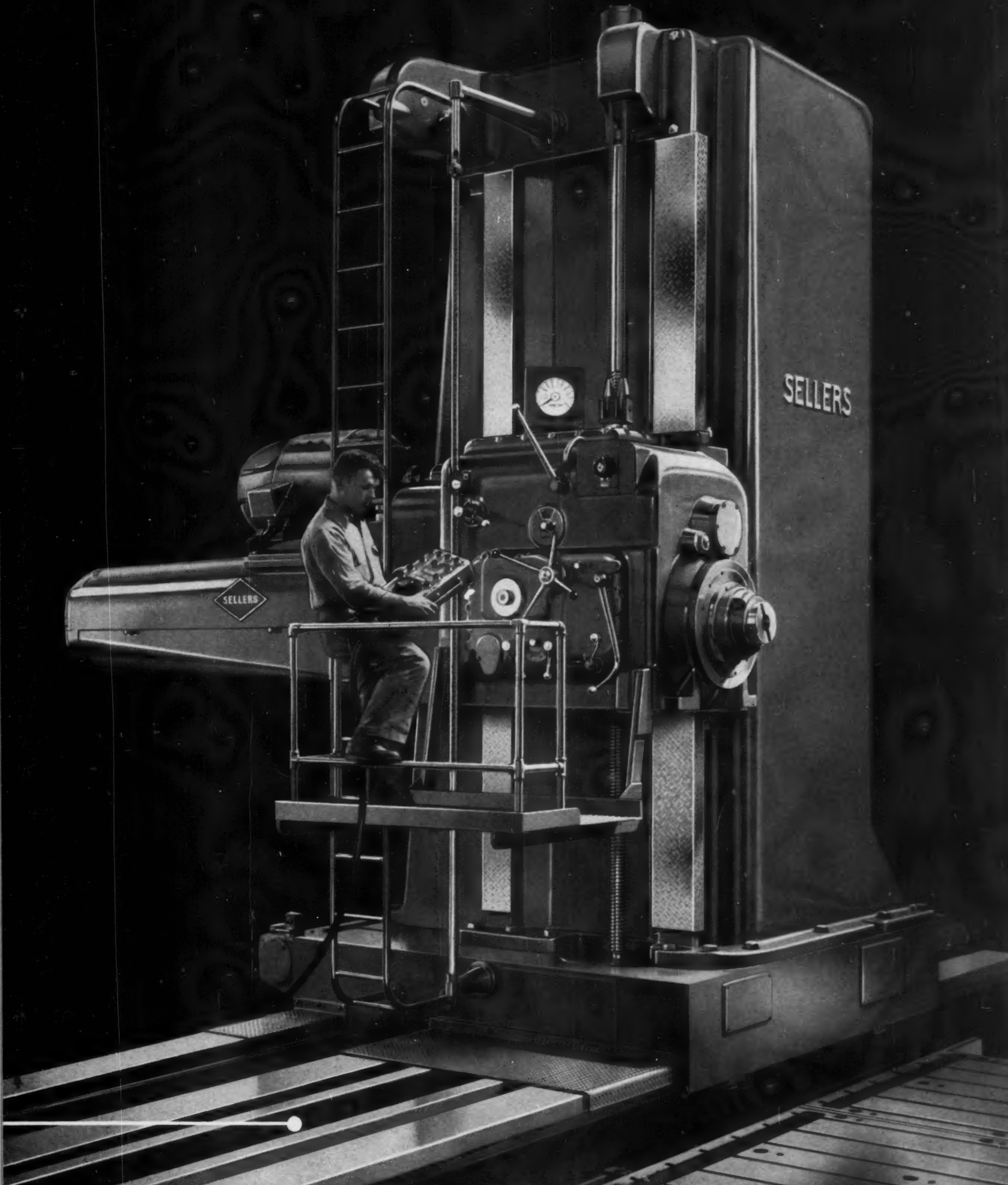

SELLERS
SELLERS

Set them, forget them—they stay tight

New high-torque Unbrako self-locking socket set screws

Research has proved that the tighter you seat a set screw the better it works. So we designed a set screw that can be tightened tighter than ever before. We formed a deeper socket. We put a radius in the socket corner. We developed fully formed threads. We established new methods of heat treatment in atmosphere-controlled furnaces. All this, plus the well-known self-locking knurled cup point that keeps it tight.

Let's see what the changes in the UNBRAKO socket mean to you. The deeper socket gives you more purchase with the wrench. Since more wrench can be put in the socket, you can tighten the screw much tighter. And you won't ream the socket or round the corners of the wrench. The radius in the UNBRAKO corners eliminates the sharp corners where cracks start. Ordinary socket screws have sharp corners which often crack even at torques much lower than those recommended for UNBRAKOs.

You can't buy a better set screw than an UNBRAKO. See your authorized industrial distributor today. Or write STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

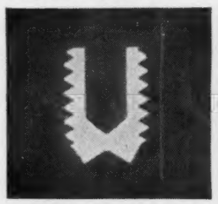
Up to 40% higher tightening torque— a new Unbrako feature

RECOMMENDED SOCKET SET SCREW TIGHTENING TORQUES (Inch-Pounds)

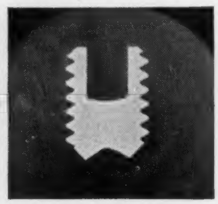
SCREW SIZE	UNBRAKO	SET SCREW B	SET SCREW C	MINIMUM DIFFERENTIAL %
#4	5	3.9	3.5	28
#5	9	7.8	7.4	15
#6	9	7.8	7.4	15
#8	20	14.7	14.5	36
#10	33	26.5	25	25
1/4	87	62	60	40
5/16	165	122	125	32
3/8	290	198	225	29
7/16	430	309	350	23
1/2	620	460	500	24
5/8	1225	1106	1060	11
3/4	2125	1540	1800	18
7/8	5000	3660	4600	9
1	7000	5025	6500	8

ALL UNBRAKOs can withstand higher tightening torques than ordinary socket set screws. For example, the recommended torque for a ¼" UNBRAKO is 87 inch-pounds—40% greater than that recommended for an ordinary socket set screw.

Unbrako Set Screw

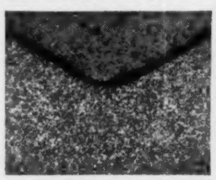


Ordinary Set Screw

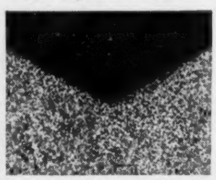


COMPARE the socket depth. The UNBRAKO socket at the left is much deeper than the socket in the ordinary set screw at the right. This additional depth in the UNBRAKO socket gives you more purchase with the wrench—you can set an UNBRAKO much tighter.

Unbrako Set Screw



Ordinary Set Screw



THE RADIUS put in UNBRAKO socket corners eliminates the sharp corners where cracks start. They distribute the stresses developed when tightening torques are applied. You can seat an UNBRAKO tighter without screw failure. Ordinary set screws have sharp corners which often crack when tightened even at lower recommended torques.

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION SPS

JENKINTOWN PENNSYLVANIA

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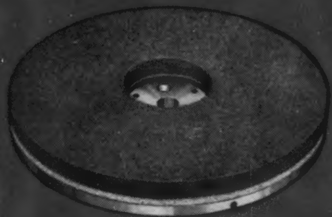
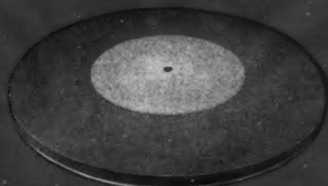
Gardner Wire-Lokt® Discs

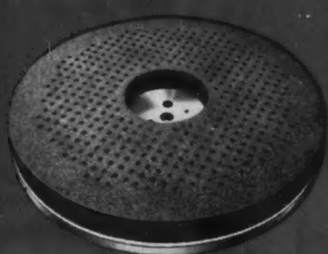


Smooth face for most general purpose grinding jobs

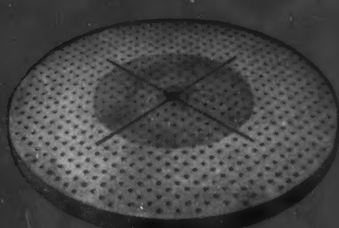


Combination grade maintains a uniform flat surface for the job requirement

Deep corrugated face provides fast, cool cutting



Combined smooth and corrugated face for shear cuts, cool cutting and good chip clearance



Combination grade and face with radial lines for even wear, cool cutting and uniform coolant distribution

How Gardner cuts grinding costs with the right abrasive for the job

—by recommending right type, grade and grain

—by selecting the best cutting surface

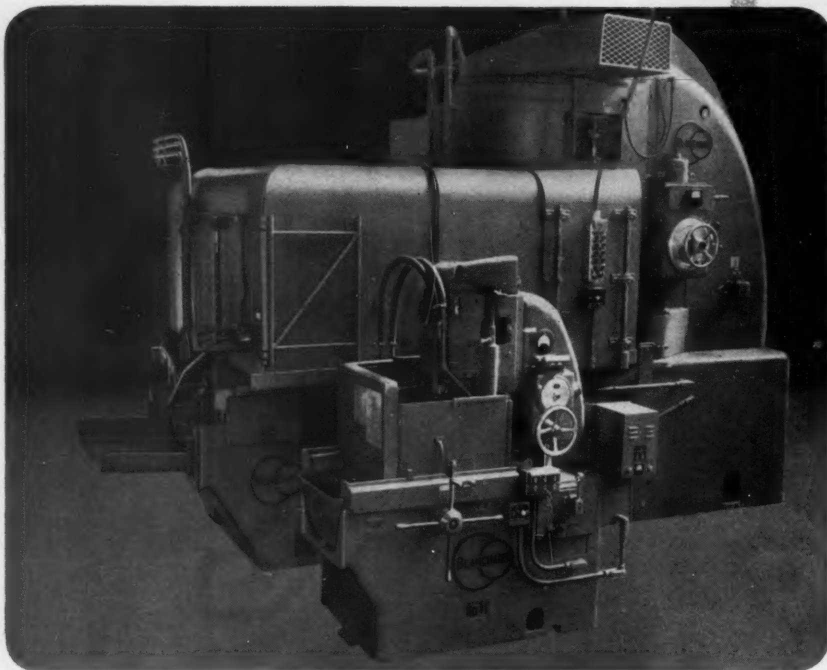
and

—by accuracy in filling repeat orders

GARDNER

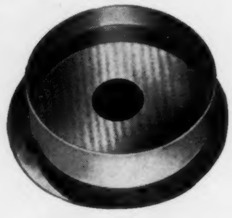
abrasive discs

BELOIT, WISCONSIN



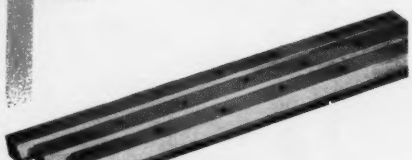
V-488

Tiny watch gears, pinions and ruby bearings — flat and parallel — to a dimension tolerance of .0002″.



To 3 micro-inches and flat within *one* light band.

Please give us a chance!

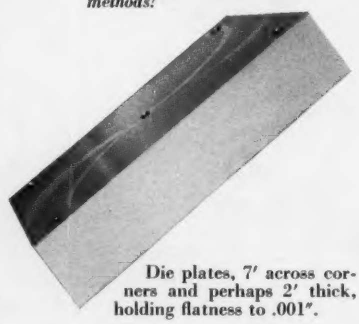


Hardened steel machine tool ways, 2½″ x 3½″ x 50″, ground on 6 sides, flat within .001″ with surface finish of 5 micro-inches — *5 times faster than other methods!*

We *know* we can do *your* flat surface jobs. We've done them all — tiny watch parts . . . steel plates 7 feet across corners . . . copper and ceramics . . . *perfectly*. Just give us the correct wheel . . . (Blanchard wheels are preferable).

Blanchards regularly grind surfaces flat to within 2 to 4 light bands, parallel to less than .0001″, with dimension tolerance of .0002″ and surface finish to better than 3 micro-inches.

Honest, we Blanchards (15 models) work fast and inexpensively — whether the job requires precision grinding or rapid removal of stock. Give us a chance to prove we're the best investment you ever made.



Die plates, 7′ across corners and perhaps 2′ thick, holding flatness to .001″.

Send for free copies of "Work Done on the Blanchard" (fourth edition), and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.**

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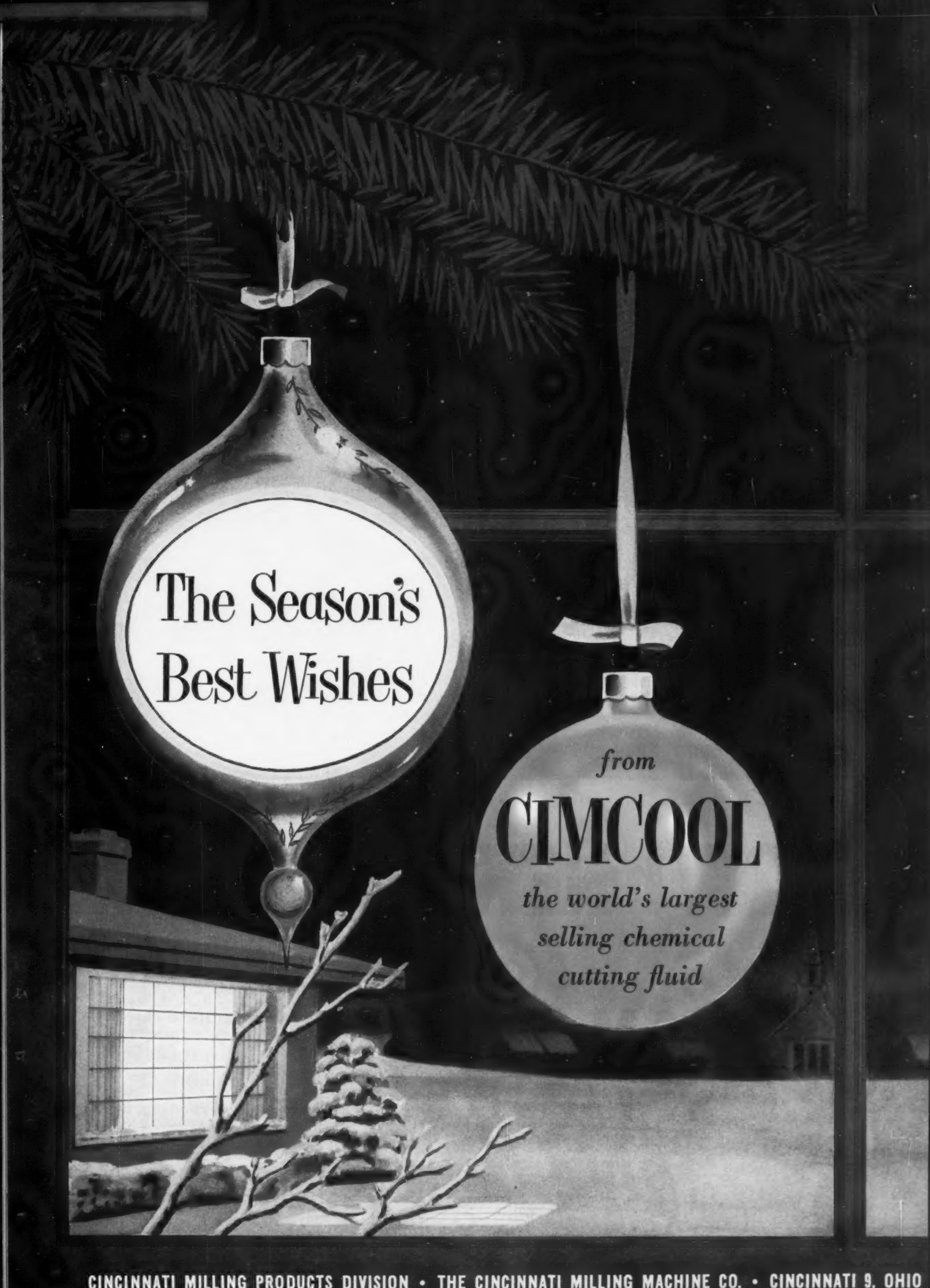
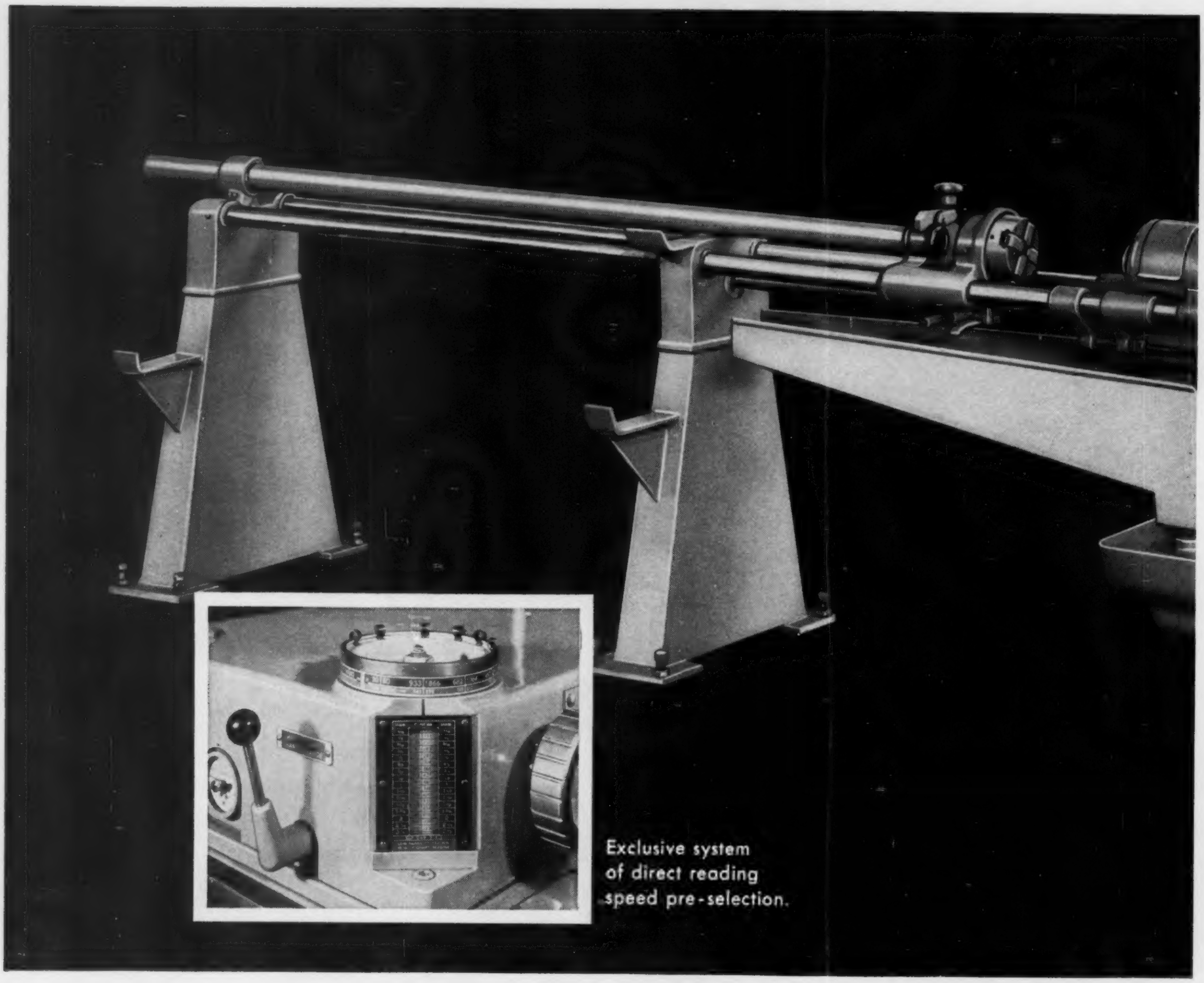


The Season's
Best Wishes
from
CIMCOOL
the world's largest
selling chemical
cutting fluid
CINCINNATI MILLING PRODUCTS DIVISION • THE CINCINNATI MILLING MACHINE CO. • CINCINNATI 9, OHIO

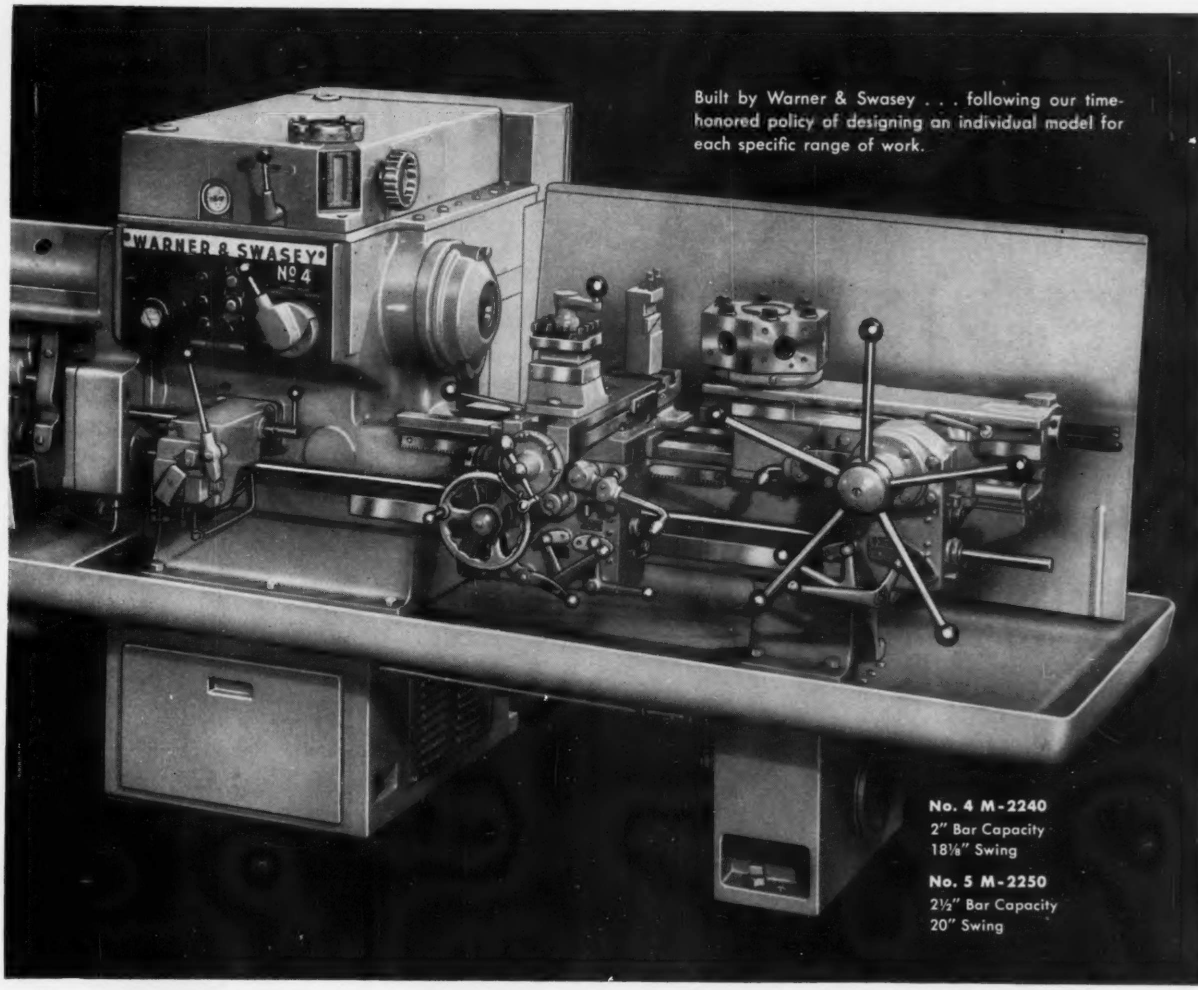


Exclusive system of direct reading speed pre-selection.

NOW! NEW WARNER &

RAM TYPE TURRET LATHES *give you*

- Higher Speeds
- Instantaneous speed changes—sliding gears eliminated
- Direct-acting hydraulic clutches—need no adjustment
- Smooth, quiet running, helical high-speed gears
- Short, stubby shafts—anti-friction bearings throughout
- Single lever control for forward, reverse, brake and free spindle
- One lever control for speed



SWASEY No. 4 and No. 5

changes and 6:1 ratio high-low shift

- Two-speed motor provides 24 *unduplicated* speeds, forward and reverse, with a 62.5 to 1 over-all range
- Flange-mounted, direct-drive motors—no belts
- Patented direct-reading speed pre-selector—calibrated in rpm's, surface speed and work diameter
- Rigid, heavy-duty, high speed hydraulic bar feed with adjustable feed-out
- Single lever control for hydraulic collet chuck and bar feed
- Zoned operating controls for effortless machine operation
- One-piece head and bed for greatest possible accuracy
- Larger, separate oil sump provides cooler filtered oil
- Retains Warner & Swasey standard tooling interchangeable with your present models

75TH ANNIVERSARY YEAR
WARNER & SWASEY
Cleveland
PRECISION MACHINERY
1880 — 1955

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

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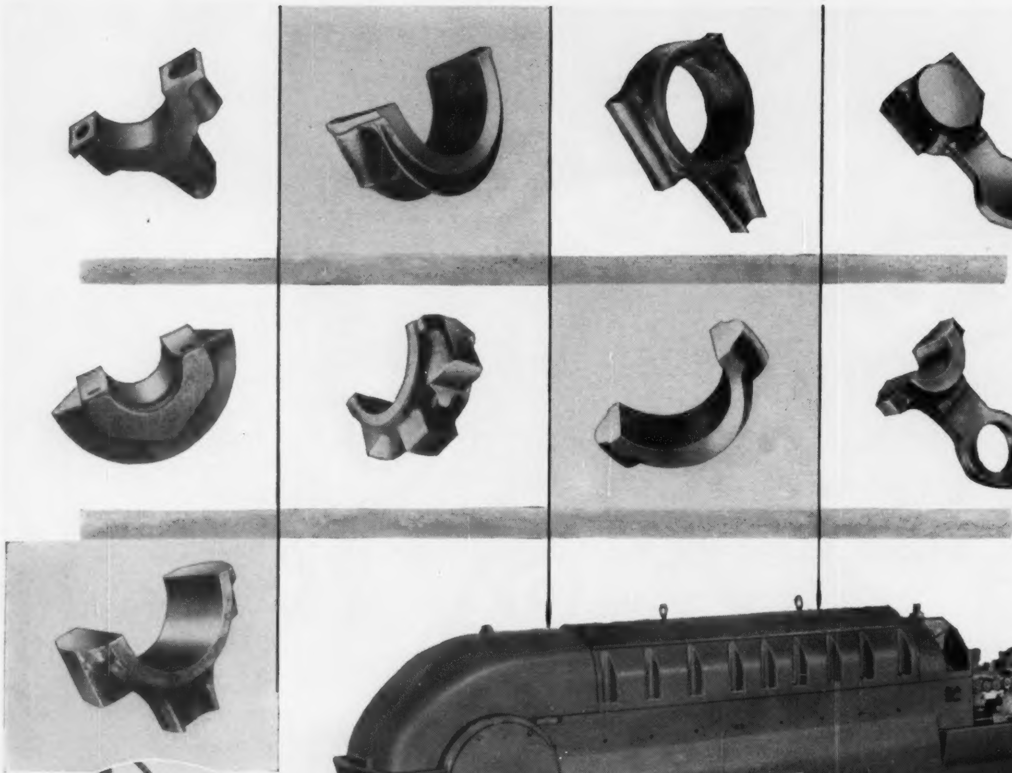
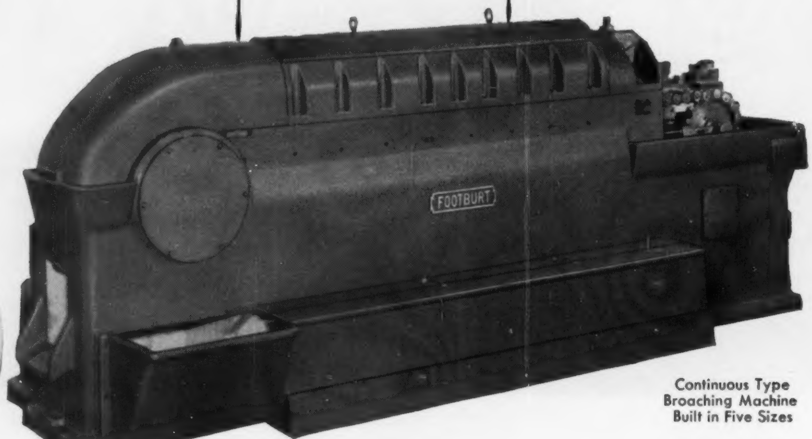


Holding Fixtures are designed for quick, convenient loading, with automatic clamping, unclamping and unloading.



Continuous Type Broaching Machine Built in Five Sizes

machining connecting rods and caps an opportunity for

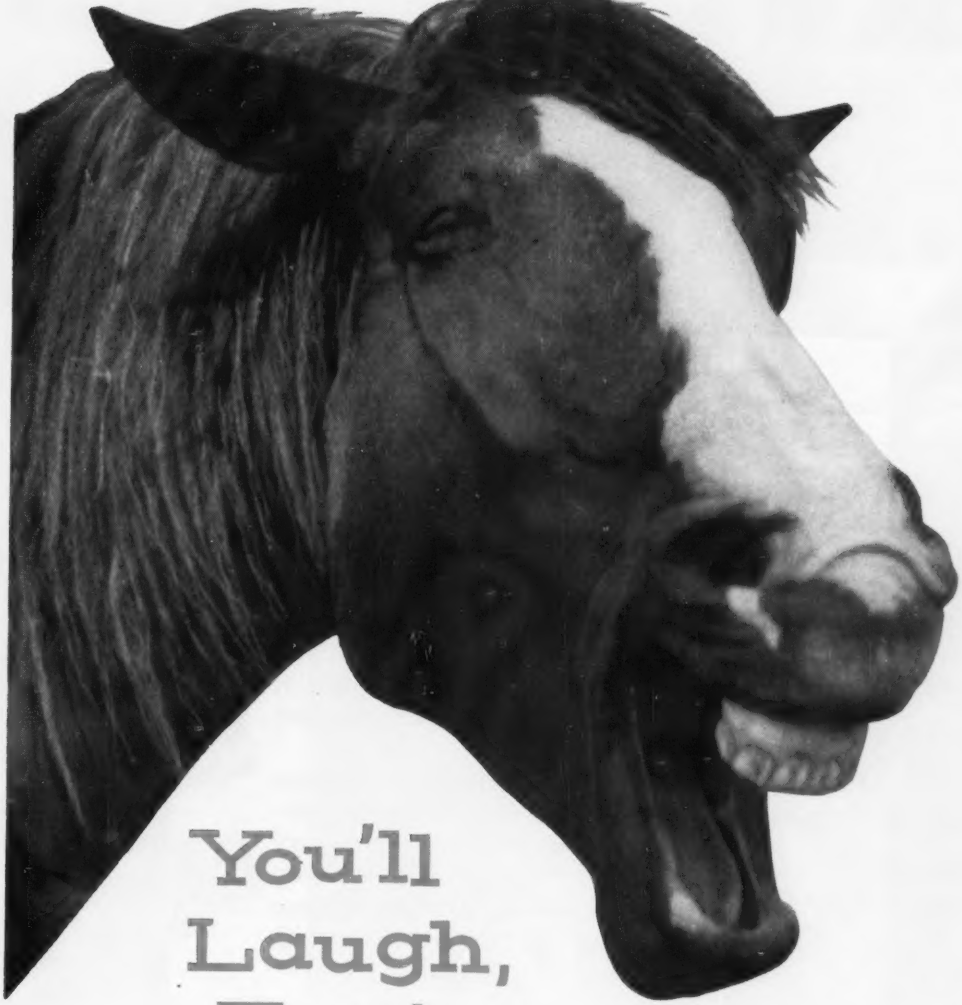
Surface Broaching

Surface Broaching is a modern machining method that in many cases shows reduced costs through higher production, finish to closer tolerance, and low tool maintenance costs. If you machine large quantities of duplicate parts we will be glad to work with you on the possibility of adopting Footburt Surface Broaching Machines. Send us blueprints and hourly production requirements for our recommendations.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

FOOTBURT

PIONEERS IN SURFACE BROACHING



You'll Laugh, Too!

YOU'LL GIVE YOUR GRINDING PROBLEMS A LONG, DRAWN OUT HORSELAUGH WHEN YOU SWITCH TO CINCINNATI (PD) WHEELS.

For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that *can save you money . . . and increase your production.*

And you'll keep right on smiling with pleasure every day that CINCINNATI (PD) WHEELS are on the job. Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.* So, doesn't it make good horse sense to get full details on CINCINNATI (PD) WHEELS right away?

Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

Remember—*only* CINCINNATI Grinding Wheels give you . . .

(PD) POSITIVE DUPLICATION

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

CINCINNATI
Grinding Wheels

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For more information on products advertised, use Inquiry Card, page 231

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

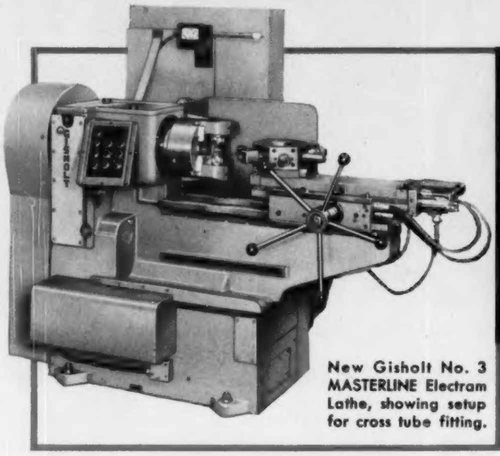
START MODERNIZING NOW

FOUR ENDS MACHINED IN SINGLE OPERATION

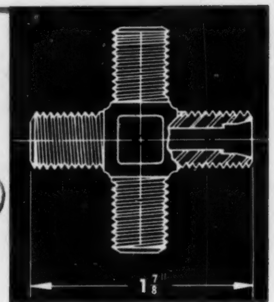
New Electram with pre-set controls boosts production

Here is a fast, positive, low-cost solution to handling parts requiring machining on two or more ends or sides—such as small to medium valves, tees, crosses, etc.

The machine is the new Gisholt MASTERLINE No. 3 Electram Lathe. The workpiece is a steel union cross tube fitting. All four ends are machined in a single chucking.



New Gisholt No. 3 MASTERLINE Electram Lathe, showing setup for cross tube fitting.



Steel union cross tube fitting, showing surfaces machined on all four ends.

A Gisholt-Weatherhead Chuck is used to permit power indexing of the workpiece without stopping the spindle. Electrical controls at the rear of the turret ram are pre-set for each turret station and govern spindle speed, spindle reverse for tapping, spindle stop and single or double indexing of the hexagon turret.

Hexagon turret tools face, chamfer, center, turn O.D., drill, form a 24-degree angle seat and a 15-degree angle bushing seat at all four ends. The workpiece is indexed in the chuck, so that tools on each hexagon turret station machine all four ends before indexing to the next turret station. To complete the part, all four ends are threaded, with the spindle reversing each time to withdraw the die head. Floor-to-floor time? Just 1.50 minutes.

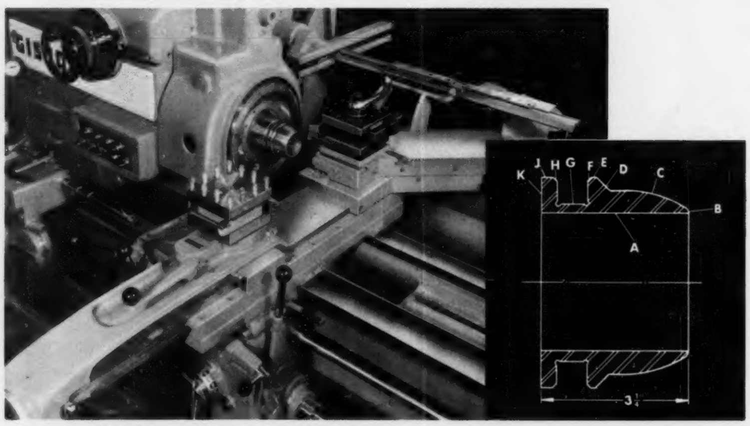
Through this well-planned setup, multiple operations are handled on each of four ends of union cross tube fittings—with high volume output at lowest cost.

JETracer SAVES ON TIME, TOOLING COSTS, INSPECTION

Simple application on Saddle Type Turret Lathe

The problem: how to machine steel bar feed wedges from 4½" diameter stock in one fast operation.

The solution: a new Gisholt MASTERLINE 2L Saddle Type Turret Lathe, equipped with a JETracer and a 40 HP motor.



All surfaces handled in one fast operation. Close-up shows JETracer on rear of bridge-type cross slide.

To feed the 4½" diameter bar stock through the 4⅜" spindle bore, an outside operated collet chuck is used. The JETracer, mounted on the rear of a bridge-type cross slide, provides an economical means of accurately machining the contoured O.D. of the wedge. Considerable time is saved, tooling costs are reduced and inspection is greatly simplified.

Machining begins with the rough bar stock fed through the collet, against a hexagon turret stop. Other hexagon turret tools start drill, drill and rough and finish bore A. A single cutter turner reduces the stock O.D. in preparation for contour turning. Square turret tools rough and finish groove and chamfer F-G-H. The JETracer carries two tools (in an indexing-type square turret) which rough and finish generate B-C-D-E-J in two quick passes. The bar feed wedge is cut off at K from the front of the cross slide, and the job is finished. F.t.f. time is 8.50 minutes.

Time is saved and inspection is simplified on this job through a most modern machine and smart tooling.

GISHOLT

LOOK AHEAD . . . KEEP AHEAD . . . WITH GISHOLT

WITH THE GISHOLT MASTERLINE

TIME-SAVING IDEAS

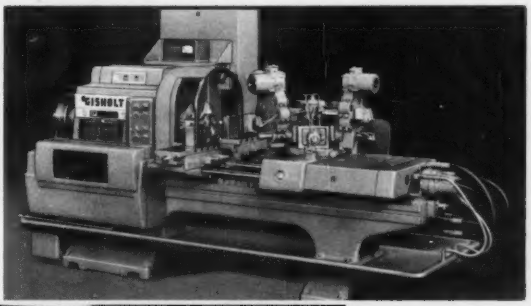
NEW FASTERMATIC CUTS SETUP TIME 50%

Simple toggle switches govern all machine functions

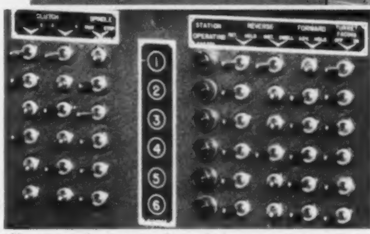
This new Gisholt MASTERLINE 2F Fastermatic Automatic Turret Lathe makes quick work of steel gear blank forgings. The secret is a new, electrically-controlled setup panel which simplifies and shortens set-up.

GEAR A—*Operation 1:* Hexagon turret fully tooled for both operations. Stations 3 and 6 bypassed. Stations 1, 2, 4 and 5 machine A-D-G-H. Cross slide tools machine B-C-E-F. F.t.f. time: 5.05 minutes. *Operation 2:* Change-over—one hour. Cross slide tools and chuck jaws changed, cross slides set to operate with stations 3 and 6. Stations 1, 2, 4 and 5 by-passed. Stations 3 and 6 machine M-J. Cross slide tools machine K-L-N-P. F.t.f. time: 1.50 minutes.

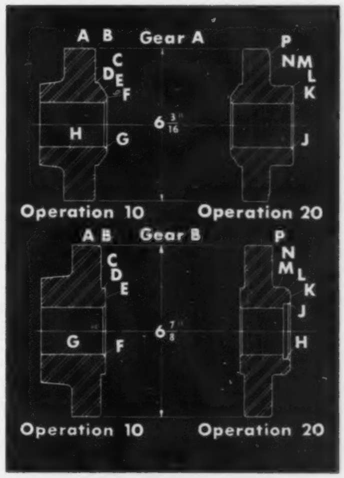
GEAR B—*Operation 1:* Change-over—1¾ hours. Adjust tools on stations 3, 4, 5 and 6 and change on stations 1 and 2 and on cross slides. Chuck jaws and spindle speeds changed and cross slides set to operate with stations 1 and 4. Stations 3 and 6 by-passed. Stations 1, 2, 4 and 5 machine A-F-G. Cross slide tools machine B-C-D-E. F.t.f. time: 5.75 minutes. *Operation 2:* Change-over—1 hour. Cross slide tools and chuck jaws changed, cross slides set to operate with stations 3 and 6. Stations 1, 2, 4 and 5 by-passed. Stations 3 and 6 machine M-H-J. Cross slide tools machine K-L-N-P. F.t.f. time: 1.39 minutes.



New Gisholt MASTERLINE Automatic Turret Lathe, designed to cut setup time 50%.



Close-up shows toggle switch control panel on new Gisholt Fastermatic.



Initial setup of the new Fastermatic is fast—simple toggle switches are set to govern all machine functions. On re-runs, a master reference card is used to further setup time.

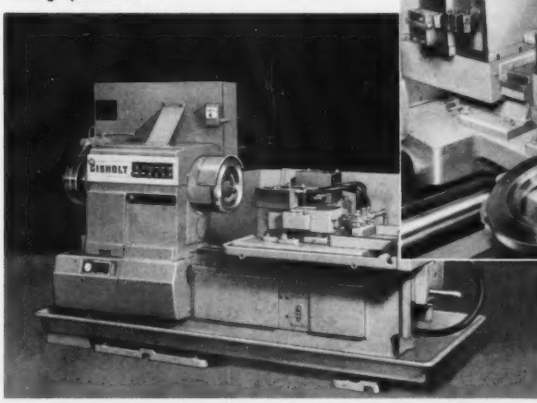
BEVEL GEAR FORGINGS IN 1.75 MINUTES F.T.F. TIME

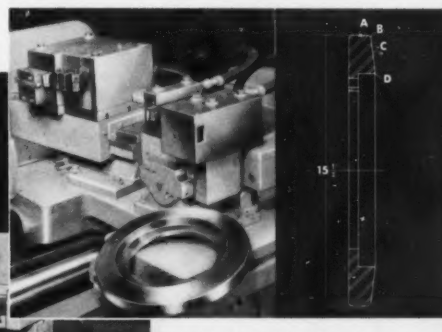
New MASTERLINE Simplimatic does low-cost job

Tough steel bevel gear forgings are a pushover on the new Gisholt Simplimatic Automatic Lathe.

Here's the operation: the part is centralized in the previously machined bore and chucked on the web in a draw-back clamp fixture. The platen table traverses forward, carrying slides and tools into position. The rear slide is set at the proper angle to machine the bevel face C. As the lead tool—held in a separate auxiliary slide—begins to feed, it is cammed to plunge into the face to roughing depth. Then, as slide movement continues, the lead tool feeds across with other rear slide tools following, to machine bevel face C and radius B. At the same time, front slide tools turn A and form radius D. F.t.f. time: 1.75 minutes.

New Gisholt MASTERLINE Simplimatic Automatic Lathe, designed for high-speed automatic machining operations.





Tooling setup for bevel gear job. Both slides have adjustable tops to speed tool setting. Rear slide has swivel base to simplify angular adjustment.

Fully automatic cycle of Simplimatic lets one man do two-man job; reduces f.t.f. time; cuts machining costs.

TALK TO GISHOLT ABOUT MACHINE TOOL LEASING

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KEEP YOUR PRODUCT

a Step Ahead of

COMPETITION

Through Lower Costs . . .
Increase Efficiency . . .
Greater Production Output . . .

Unless your present equipment is as modern as the Bullard Horizontal Boring, Milling and Drilling Machine, Model 75, you are not employing all of today's engineering achievements to your manufacturing methods. You owe it to yourself to investigate the many advantages to be gained by using the Bullard Horizontal Boring, Milling and Drilling Machine, Model 75 in your plant.

HERE ARE SOME OF ITS FEATURES

PENDANT CONTROL – complete machine control from a movable pendant station. Feed and speed rate selection, directional feed and traverse engagement of the spindle, head, table and saddle, spindle rotation and operation of head binders are accomplished from the Pendant.

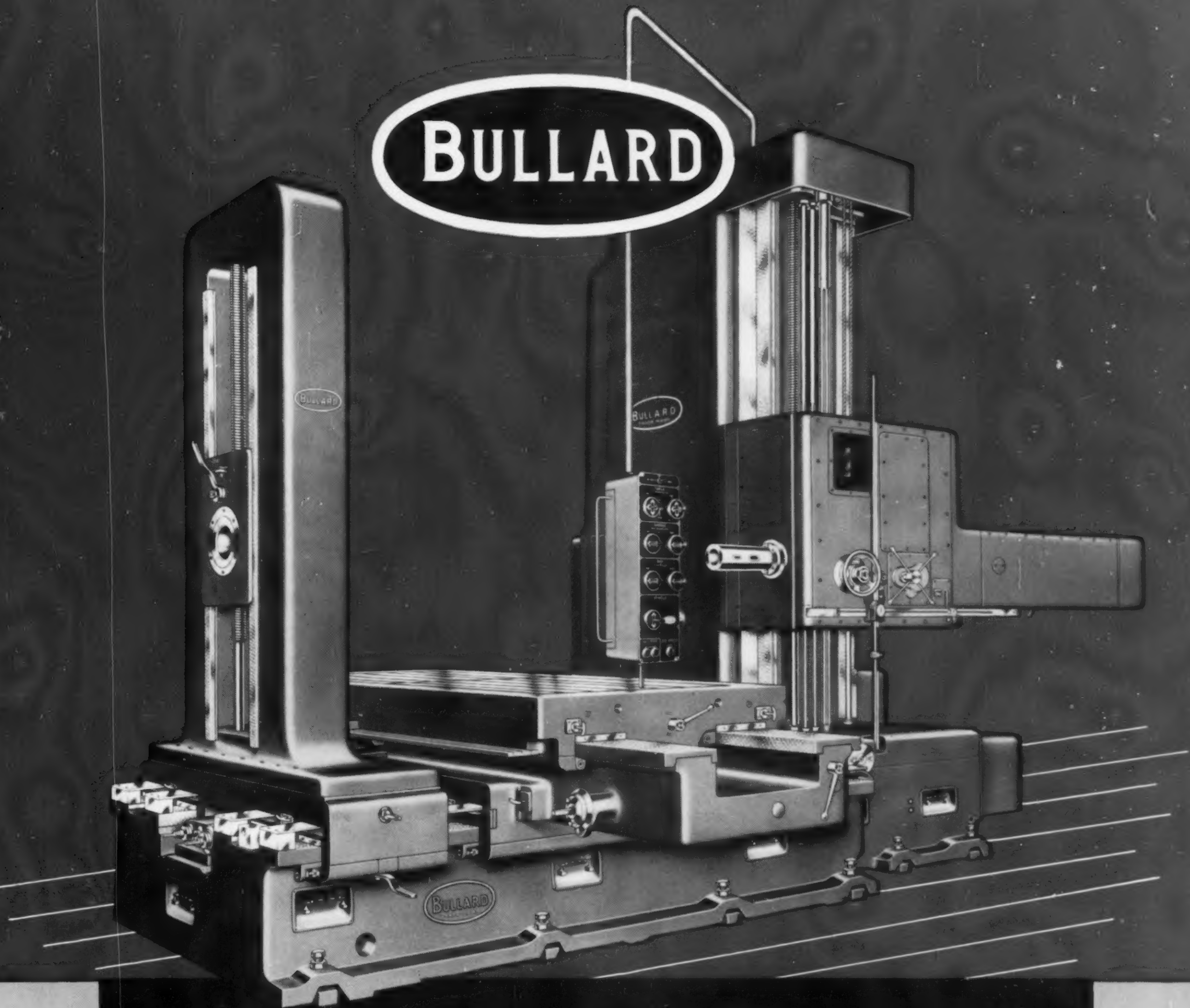
BOTH SCREW AND RACK FEED – to the spindle provide smooth, steady screw feed for boring and sensitive hand feed for small drilling and tapping.

SPEED RANGES – 9.5 to 2032 R.P.M. on 3", 7 to 1510 R.P.M. on 4" standard and 5.8 to 1209 R.P.M. on 4" heavy duty and 5" sizes, meets any machining requirement.

RIGIDITY – is built into the massive 4-Way Bed, Head, Headpost and Rear Post assuring a higher degree of maintained accuracy.

OPTICAL MEASURING EQUIPMENT – for head and table (optional)

AUTOMATIC POSITIONING – for head and table (optional)


BULLARD

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on an *Acme-Gridley*

FULLY AUTOMATIC BAR TYPE TURRET LATHE

you can machine this finger-holder spool in 3 minutes

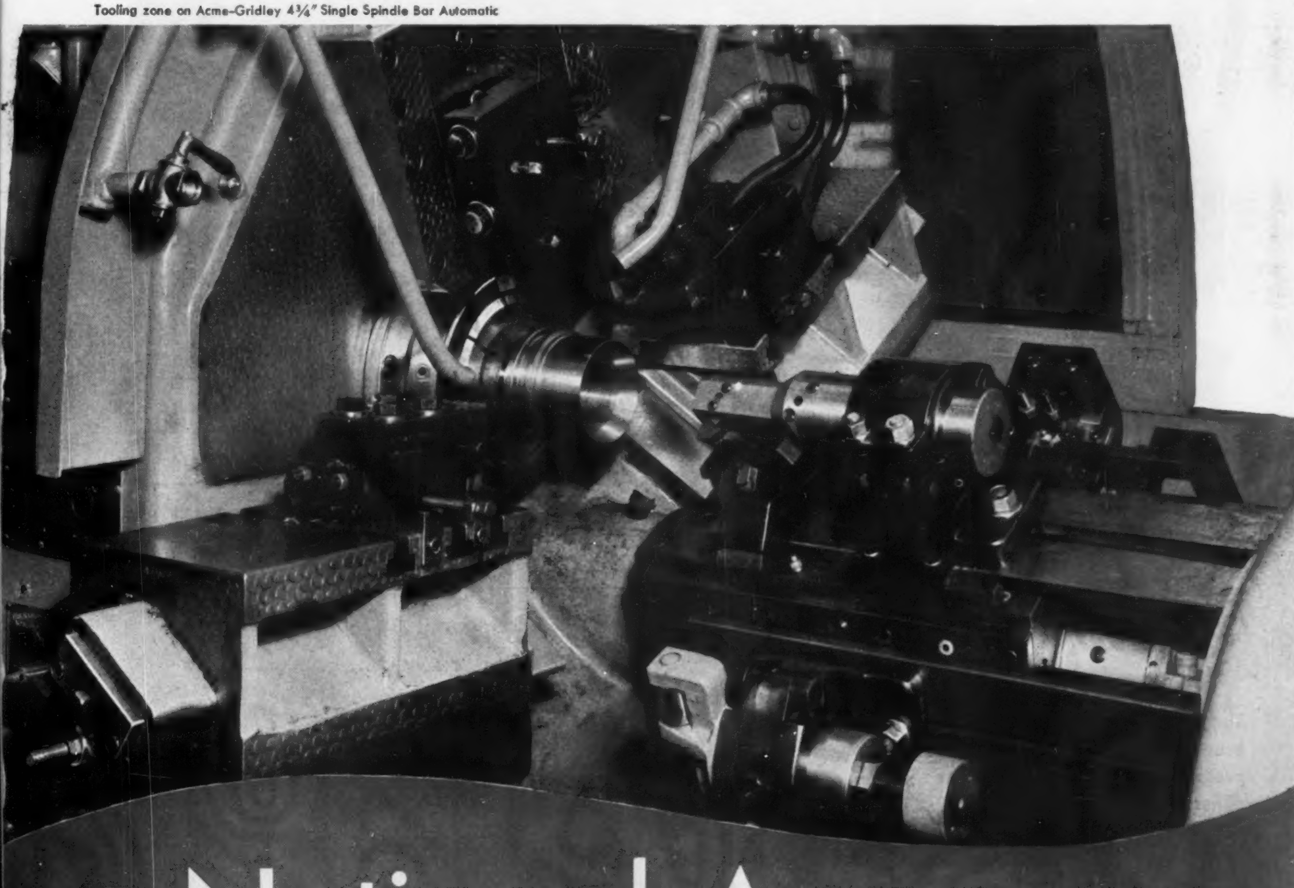
. . . and do it all day long!

Material—4620 Steel Tubing
Machine Time—3 Minutes
Number of Operations—15, including angular turning attachment; carbide tooling throughout.

Here's the answer: Dependable, automatic control of the work cycle . . . production is always at the same predetermined rate. Also, on the ACME-GRIDLEY Single, you complete more operations on the primary tooling setup—the best way to get greater accuracy, save time and save floor space. *And* one man can operate two or more machines, depending upon the cycle time of the work involved.

Why not learn more about the machine that made such a big hit at the Machine Tool Show? Get the full details in Catalog M-50A . . . then you'll *want* to discuss your production with a National Acme engineer.

Tooling zone on Acme-Gridley 4¾" Single Spindle Bar Automatic



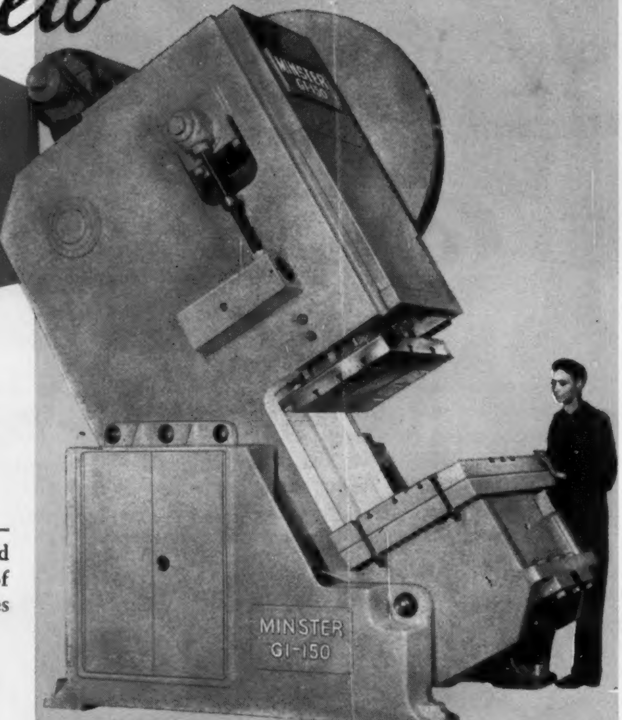
the National Acme company

179 EAST 131ST STREET • CLEVELAND 8, OHIO

Minster announces a completely

New

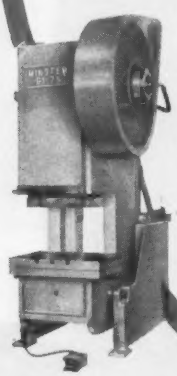
STEEL FRAME GAP PRESS



SERIES G1 PRESSES

Patents Pending

Today's most rigid and efficient gap presses—G1 Steel Frames, are engineered and fabricated with a completely new approach to the problem of achieving minimum deflection in steel "C" frames for gap presses.



CAPACITIES OF
75, 110, 150 and 200 Tons

- Fixed Base or Inclinable
- Flywheel or Geared Types
- Minster Patented Combination Air Friction Clutch and Brake
- Barrel Slide Adjustment and extremely long Slide Ways
- Power Inclining

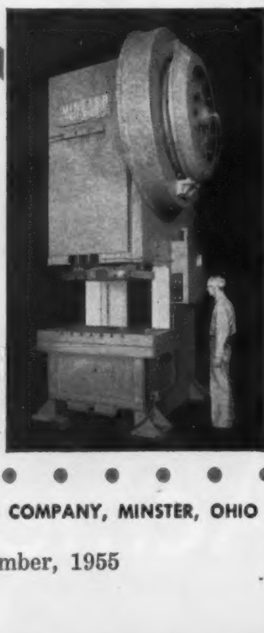
▲
Series G1-75 flywheel type inclinable gap press with manual inclining and standard leg.

MINSTER G1-150 ton geared type gap press—Motorized Inclining—Cabinet Legs house all electrical and air controls—Connect Air Line and Plug in power; in seconds, it's ready to operate.

CONDENSED STANDARD SPECIFICATIONS

CAPACITY	STD. STROKE of slide	STROKES per minute	BED AREA	SLIDE AREA
75 tons	4	Flywheel 90 or 120 Geared 40	24 x 36	18 x 24
110 tons	5	Flywheel 80 or 105 Geared 37	27 x 42	21 x 28
150 tons	6	Flywheel 80 or 105 Geared 30	30 x 50	24 x 34
200 tons	8	Geared 28	34 x 58	28 x 36

The 200 ton G1 fixed base geared type gap press—Available with either bed attached or sliding type die cushion. ▶



Build a sound replacement program modernize with Minster Presses

MINSTER®
PRESSES

THE MINSTER MACHINE COMPANY, MINSTER, OHIO

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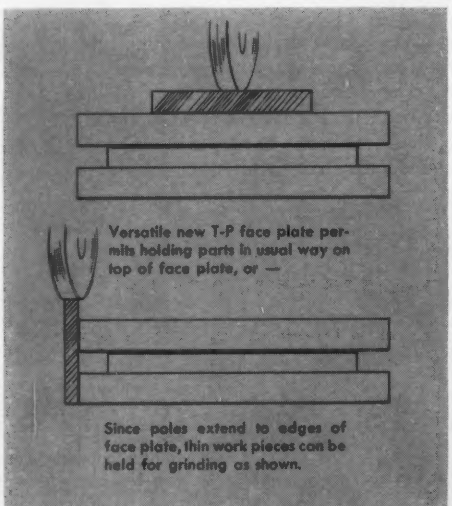
New Face Plate on Taft-Peirce Permanent Magnet Chucks



Versatile new T-P face plate permits holding parts in usual way on top of face plate, or —

Since poles extend to edges of face plate, thin work pieces can be held for grinding as shown.

Increases Capacity Simplifies Setups

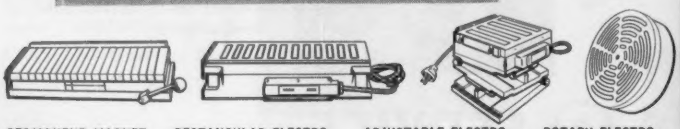
Now lower, longer, and stronger T-P Superpower Permanent Magnet Chucks offer you more surface plate area to work with. Poles extend to edges of face plate to eliminate waste space and dead spots.

15 to 20% lower in height than other Permanent Magnet Chucks, these Superpower Chucks give you more clearance between wheel and chuck.

Since poles extend the full width of face plate, sides of chuck can be used for grinding edges of thin sections. Simplifies complicated setups.

In addition, a Superpower P-M Chuck has more magnetic poles for its size — gives you a greater effective working length.

Extra-sturdy construction assures maximum dependability, minimum maintenance. Now available in a range of standard sizes. Also in sine angle chuck models. Specials on request. Write for more information.



PERMANENT MAGNET CHUCKS — RECTANGULAR ELECTRO-MAGNETIC CHUCKS — ADJUSTABLE ELECTRO-MAGNETIC CHUCKS — ROTARY ELECTRO-MAGNETIC CHUCKS

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

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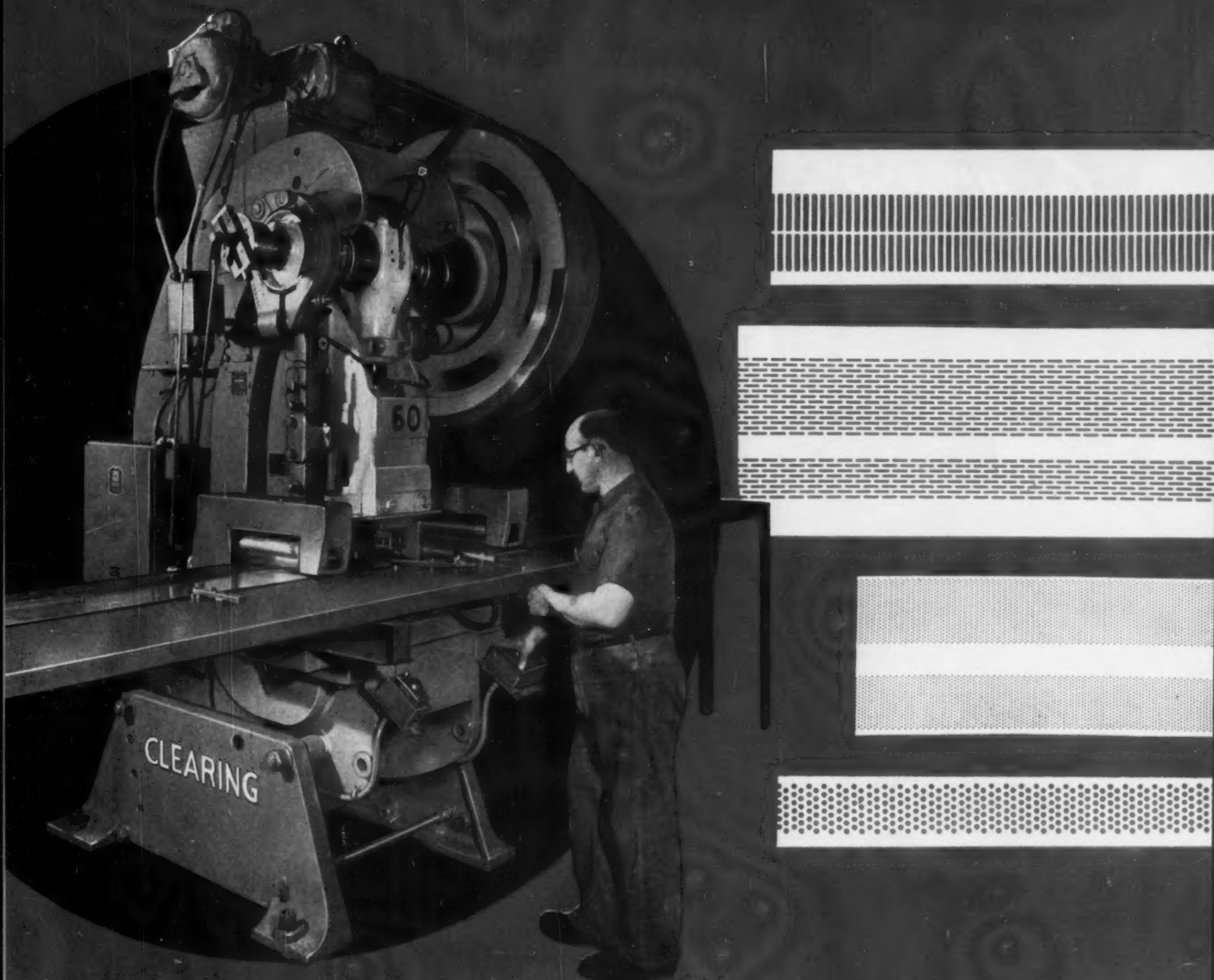


high production–60 tons' worth

Here's a sixty ton Clearing O.B.I. that's really pulling all its weight at the Hussmann Refrigerator Company in St. Louis. Hussmann required a variety of patterns in ventilator panels for their line of commercial refrigerators. Instead of making each panel separately, they produce a continuous pattern from automatically fed strip stock. Simple die changes make it possible to change the pattern easily and quickly. An open end roll feed and vari-speed drive on the press gets top output out of every working hour.

There's a way that the efficiency of a Clearing O.B.I. can solve a production problem for you. It gives you the kind of smooth operation your operators will go for and the ruggedness that comes through for you in the pinches. We'd be glad to talk to you personally about these things. Why not call us?

Write for your copy of Clearing's O.B.I. catalog. We'll send it promptly at no obligation.

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION

DIVISION OF *U. S. INDUSTRIES, INC.* 6499 WEST 65TH STREET • CHICAGO 38, ILLINOIS • HAMILTON PLANT—HAMILTON, OHIO

Swanson

NOW OFFERS 3—

standard, basic machine chassis for automation ... to cut costs and shorten completion time for special purpose machines.

1

THE AUTO-TRAN
Transfer Type Indexing Unit.

Available in standard models with 48, 54, 60, 66 or 72 carriers; 3", 6", 9" or 12" index travel, and with either vertical or horizontal mounting surfaces on carriers.

2

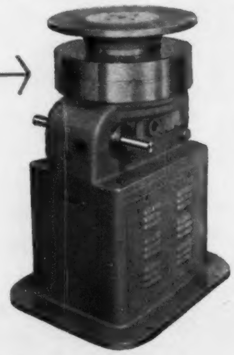
THE SERIES H (large)
Turret Indexing Unit.

Offered with a wide choice of turret diameters to 72"; with 8, 12, 16, 24 or 32 index positions, and a complete range of indexing rates and dwell times. Exclusive Swanson turret lock assures accurate positioning at each work station.

3

THE SERIES B-C (medium)
Turret Indexing Unit.

Standard models include turret diameters to 40"; 6, 8, 12, 16, 18, 24 or 32 index positions and a complete range of indexing rates and dwell times. Also features the exclusive Swanson turret lock.



If an automation program is in your present or future plans, write, wire or phone for full details on these units and other standard Swanson components and accessories.

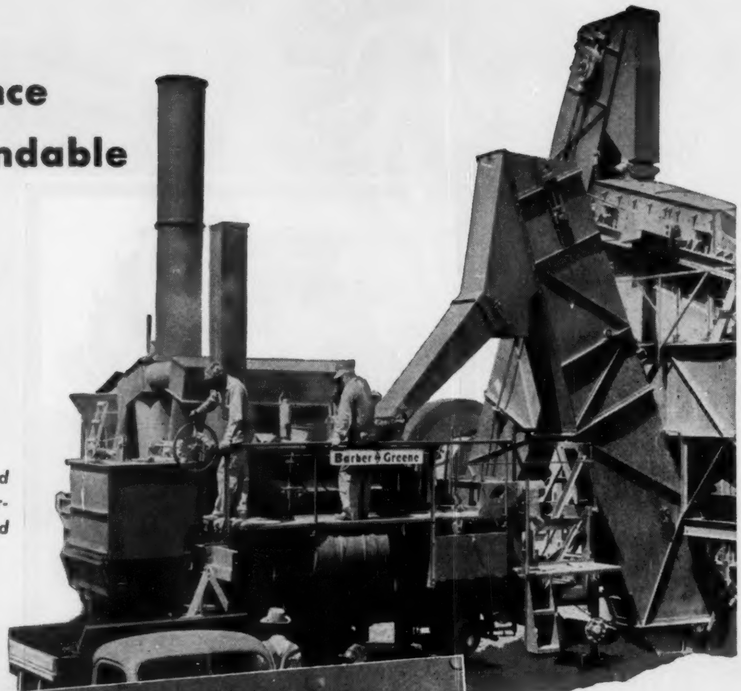
Quality — SWANSON TOOL & MACHINE PRODUCTS INC., ERIE, PA. — Since 1919

ENGINEERS and BUILDERS of AUTOMATIC and SPECIAL PURPOSE MACHINES

For more information on products advertised, use Inquiry Card, page 231


UNION TWIST DRILL CO.
ATHOL, MASS., U.S.A.

machines of great performance use the most dependable oiling system ever developed



A Model 50 Madison-Kipp Lubricator installed as original equipment on a Model 848 Barber-Greene Asphalt Mixing Plant manufactured by Barber-Greene Co., Aurora, Illinois.

MADISON-KIPP *Fresh Oil*

. . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION

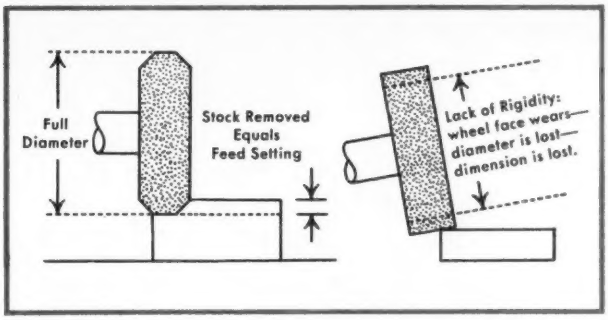
203 WAUBESA STREET • MADISON 10, WIS., U.S.A.

- **Skilled in Die Casting Mechanics** • **Experienced in Lubrication Engineering** • **Originators of Really High Speed Air Tools**

For more information on products advertised, use Inquiry Card, page 231


GRINDING ACCURATELY
TO HANDWHEEL SETTINGS!
DoALL
D-10

HOW DoALL CONTROLS GRINDER ACCURACY



"COOL-GRINDING"*
—Coolant flows *through* wheel.

1. Control of Wheel Diameter. This requires *rigidity* and *smooth, powerful table travel.* On a DoALL Grinder the leading edge of the wheel takes the brunt of the cutting. The wheel face and diameter remain true, assuring dimensional accuracy of work—see diagram above.

DoALL design eliminates table "gallop" which rapidly breaks down wheels. Even on the slow speeds of crush form grinding, travel is smooth and uniform because of an attachment which meters fluid from the hydraulic table drive cylinder.

Rapid cross-indexing during table reversal prevents damage to wheel resulting from contacting work during cross movement.

2. Control of Wheel-to-Table Dimension. The rigidity of DoALL Grinders prevents error-producing "give" and table deflection. Distance from table to wheel remains constant even during heavy cuts.

3. Control of Thermal Expansion. Overheating of the workpiece creates expansion that results in inaccuracy when the work cools. The optional DoALL "Cool-Grinding" and Flood Coolant Attachment provides greater and more uniform cooling than any other method. In "Cool-Grinding" coolant enters the wheel near the center through pick-up rings, flows through the pores and out in a fine mist, providing evaporative cooling at the point of cut where heat is generated. On heavy, sustained cutting, the flood cooling is used to assure uniform heat regulation of the entire workpiece.

Certified Size, Finish, Flatness, Parallelism—see next page ....→

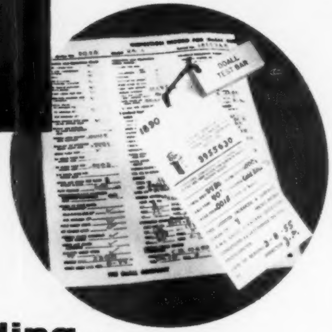
*U. S. Patent No. 2470350

Automatic Mass Production of Precision Surfaces

Complete reliance upon handwheel settings permits production line automatic grinding without constant checking of work in the DoALL grinders.

Certified Finish, Flatness, Parallelism and Accuracy.

Every DoALL Grinder must pass critical operating tests before shipment. The machine is certified to produce a 10 micro-inch R.M.S., or better surface finish. A test block on which this has been done is shipped with the grinder. A complete inspection report accompanies each grinder attesting to the performance of every component.



Get the Facts About Faster, More Accurate Lower Cost Surface Grinding . . .

Field Demonstration.

DoALL will bring a grinder to your plant and demonstrate it in "your own back-yard". You can see it and believe it—a totally new standard of surface grinder accuracy, performance, speed and economy.

LITERATURE — Ask for the new DoALL Grinder Catalog describing the design and construction of the complete line of seven models from 6″ x 18″ to 10″ x 30″.

FILMS — color, sound movies showing how you can produce more with DoALL Grinders are available for group showings. Call your local DoALL Store or write DoALL, Des Plaines, Ill.

Challenge DoALL!

—ASK FOR A DEMONSTRATION

Call DoALL for a free demonstration at your plant. Make the operator prove DoALL performance before your own eyes. You be the judge—compare DoALL performance with that of any other grinder in your plant! Call your local DoALL Store today or write. There is no obligation.

DoALL

Friendly DoAll Stores . . . (in 37 cities)

Personalized Service . . . Complete Stocks . . . Local Delivery

EDUCATIONAL STUDY WALL CHARTS

Economic Principles

$1.00 each postpaid

Lower quantity prices

For more information on products advertised, use Inquiry Card, page 231

CLEEREMAN DRILLING MACHINES

LOWEST Operating Costs!

Why?

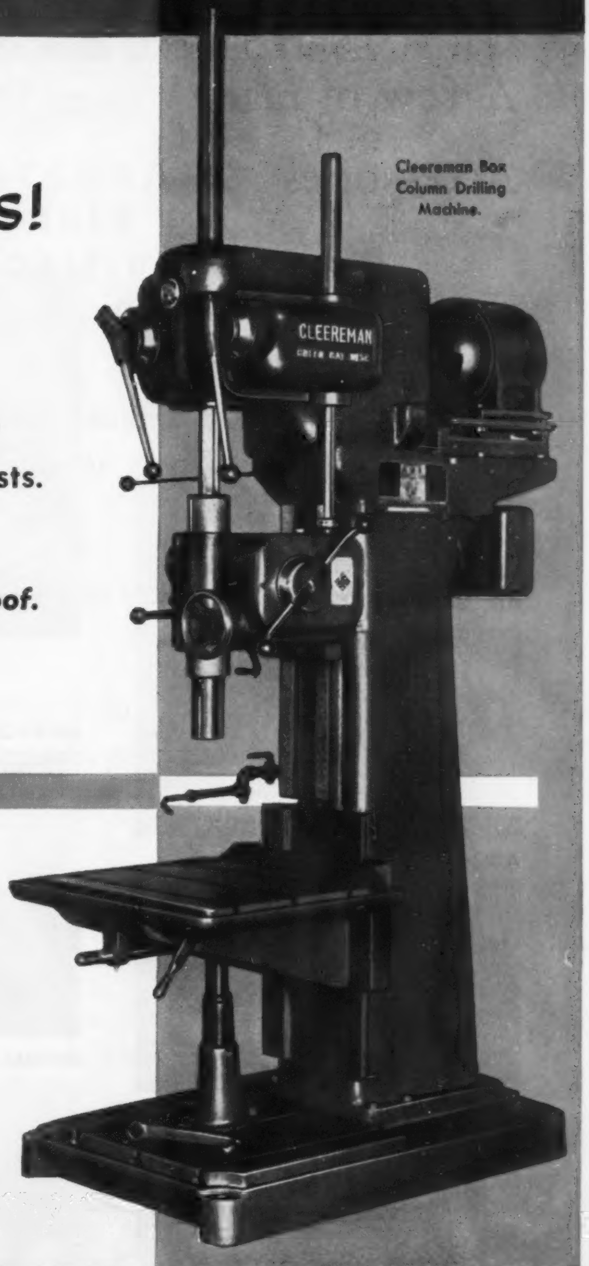
1—Eliminate Down Time.

2—More Power to Produce.

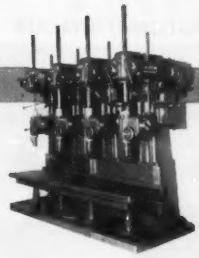
3—Lowest Maintenance Costs.

4—Less Operator Fatigue.

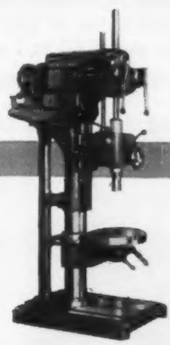
Go to any Cleereman user for proof.



Cleereman Box Column Drilling Machine.



Cleereman Multiple Drilling Machine.



Cleereman Round Column Drilling Machine.

BRYANT Machinery & Engineering Company
General Office
640 West Washington Blvd., Chicago 6
Representatives in Principal Cities

CLEEREMAN MACHINE TOOL CO. Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

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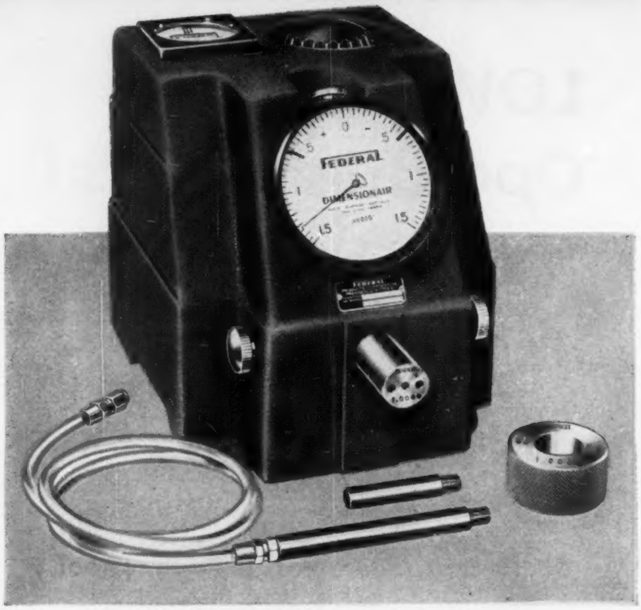
Time and Time Again . . . the

FEDERAL DIMENSIONAIR

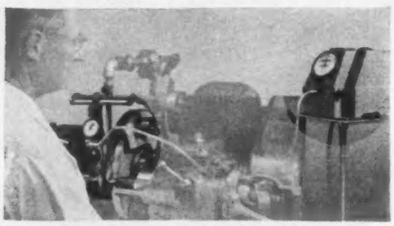
A few of many Accessories . . .



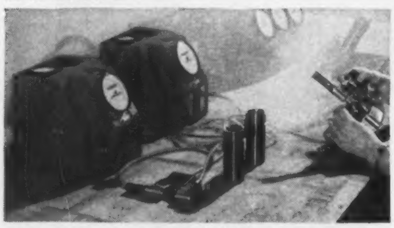
Magnifications of 2500 to 1 with .003" usable range and 5000 to 1 with .015" usable range.

AIR PLUGS AND RINGS

AIR GRINDING GAGES

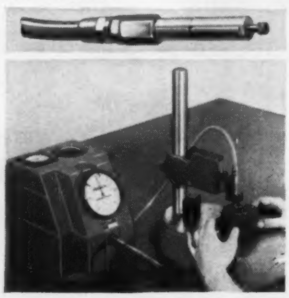


AIR SNAPS

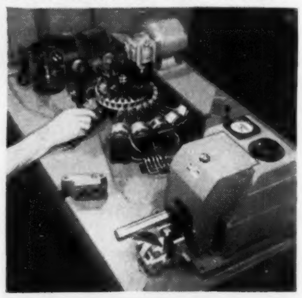


ADJUSTABLE HOLE AIR GAGES

AIRPROBES

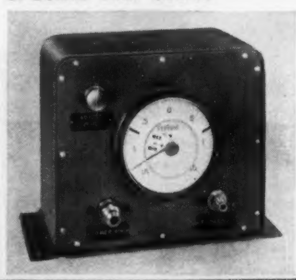


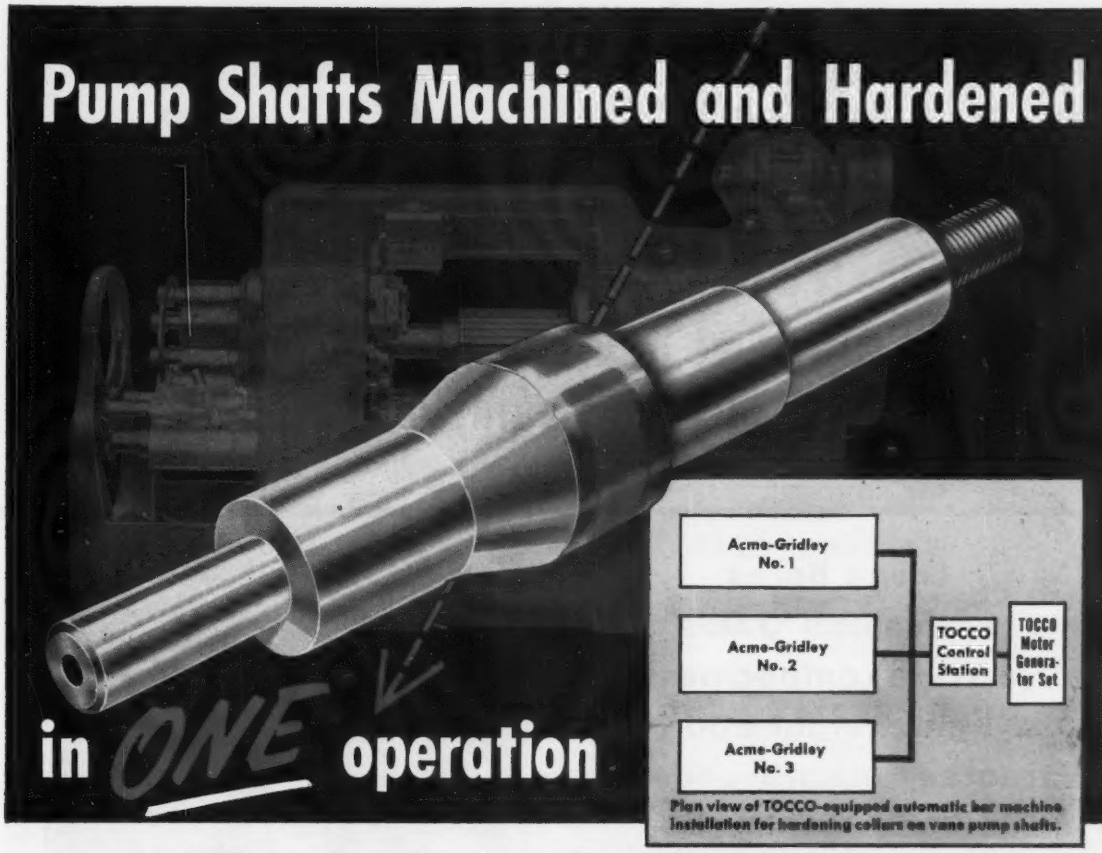
AUTOMATION AIR GAGES



SPECIAL AIR GAGES

SPECIAL AIR UNITS





with TOCCO* Induction Heating

TOCCO-equipped 8-spindle Acme-Gridley Bar Automatics at a large automotive manufacturer's plant produce vane pump shafts for power steering units in one completely automatic operation!* No handling—no hardening cost except power!

A TOCCO inductor, mounted at one station of each automatic, hardens collars on pump shafts after they have been completely machined at preceding stations on the same machine. Each installation consists of 3 automatic machines equipped with inductor coils powered by a 50 KW, 10,000 cycle TOCCO unit. Production from each installation is 360 shafts per hour.

Shafts are made of C 1144 and only the collar is hardened to prevent scoring the seal. TOCCO's rapid heating confines the hardened area to the surface of the collar leaving the rest of the shaft unaffected.

If your products or their components require heat treating, soldering, brazing or heating for forging, it will pay you to investigate TOCCO for better, faster production at lower unit costs.

A Patented Process

THE OHIO CRANKSHAFT COMPANY

JUST PUSH A BUTTON

TOCCO

*Trade Mark Reg.

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-12, Cleveland 1, Ohio
Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name________________
Position________________
Company________________
Address________________
City________ Zone____ State_____

When Your Problem is Limited Space

NORMA-HOFFMANN

Extra Light **Inch Series Bearings** are the solution

Large Bores with small O.D.'s provide compactness light weight and greater design freedom

Norma-Hoffmann *Extra Light* Inch Series Bearings — available in both ball (XLS) and roller (RXLS) types — offer engineers and designers the advantage of high anti-friction efficiency combined with exceptional compactness and light weight.

Having unusually large bores compared to outside diameters, Norma-Hoffmann extra light bearings often are the only solution where space is extremely restricted. These bearings are ideal for hollow shafts. They provide utmost accuracy, rigidity, load capacity and friction-free operation.

Size for size, the RXLS roller bearings are interchangeable with the XLS ball bearings. The full line contact of the roller surfaces provide greater radial load capacity and allow for endwise shaft expansion.

Norma-Hoffmann Extra Light Inch Series Bearings are available in ranges from 1⅜" to 22½" bore. Our field engineers will gladly help you with your bearing problems. There is no obligation of course. Write for their assistance and catalog.

XLS Series for radial and thrust loads

RXLS Series for heavy radial loads and endwise shaft expansion

NORMA-HOFFMANN
Precision **BEARINGS**
BALL · ROLLER · THRUST

NORMA-HOFFMANN BEARINGS CORPORATION
STAMFORD, CONNECTICUT

FIELD OFFICES: Atlanta, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, San Francisco, Seattle

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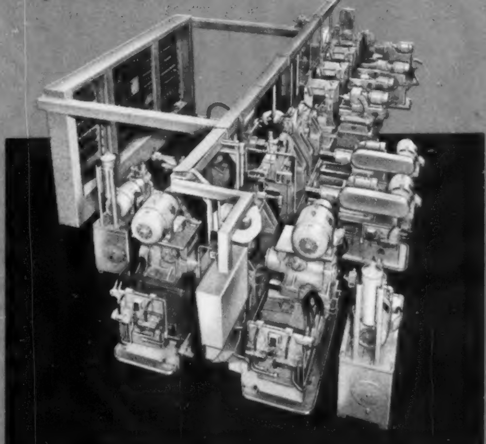
SNYDER SEGMENTED AUTOMATION in 91 station, 182 operation, in-line transfer machine features four segments which can operate independently or as a unit to assure continuous production of automotive automatic transmission cases at 100 cases an hour at 80% efficiency

SNYDER

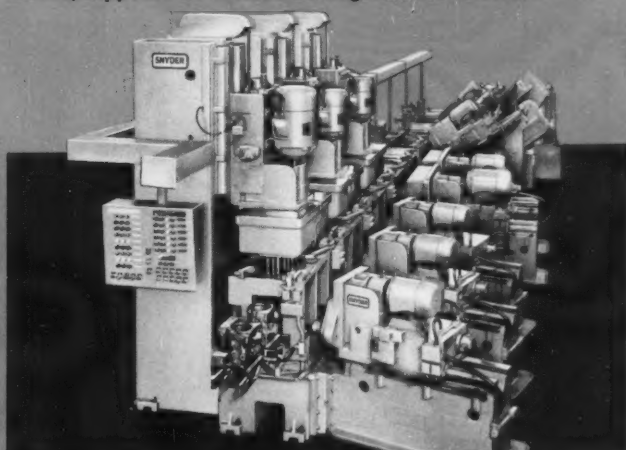
TOOL & ENGINEERING COMPANY
3400 E. LAFAYETTE, DETROIT 7, MICHIGAN

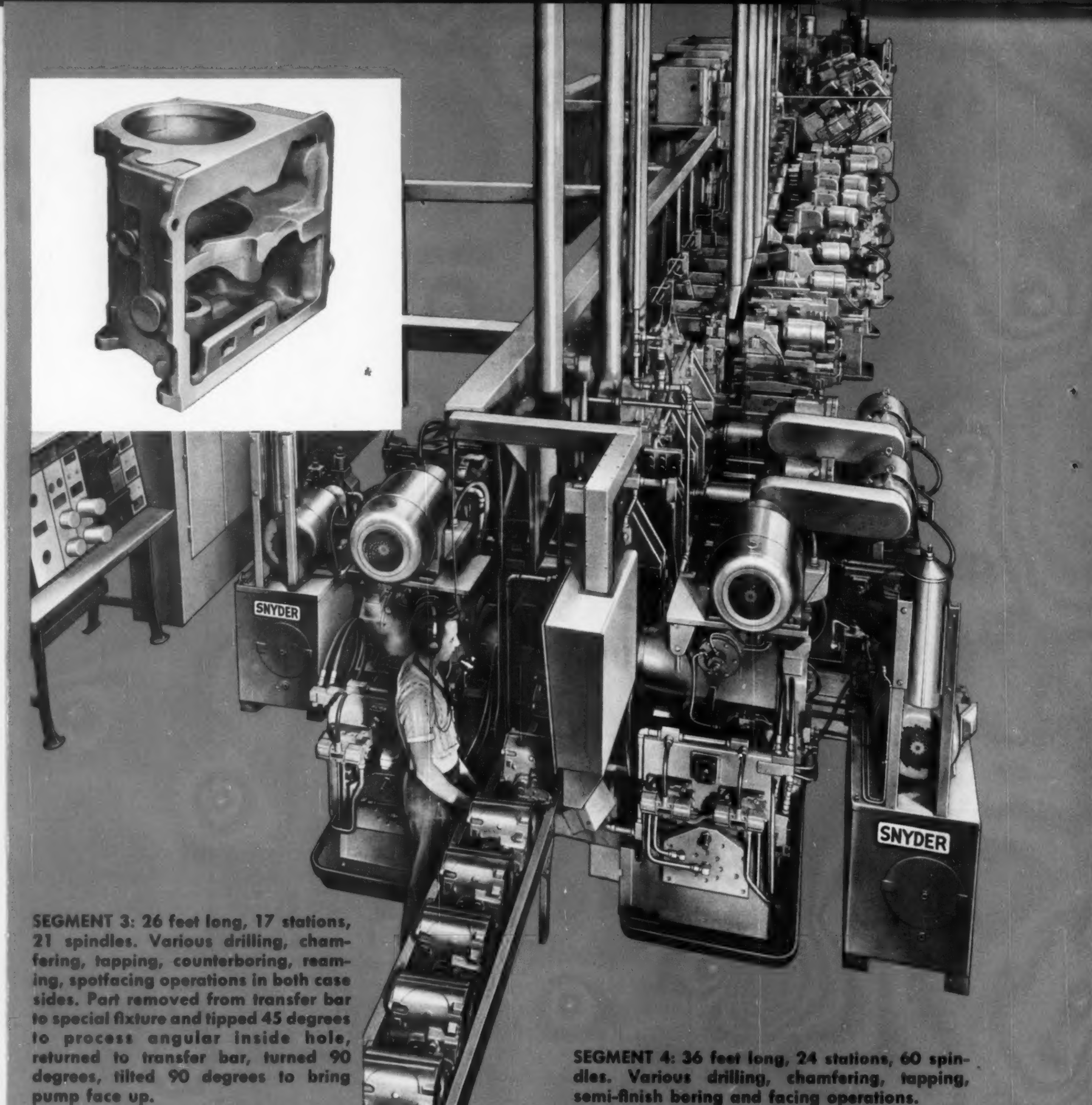
30 Years of Successful Cooperation with Leading American Industries

SEGMENT 1: 40 feet long, 19 stations, 10 spindles. Part manually loaded, both ends face milled, counterbored, three diameters rough and finish bored and faced, two pads side milled, pump pad face milled, clearance slot milled. Part tilted 90 degrees in processing.



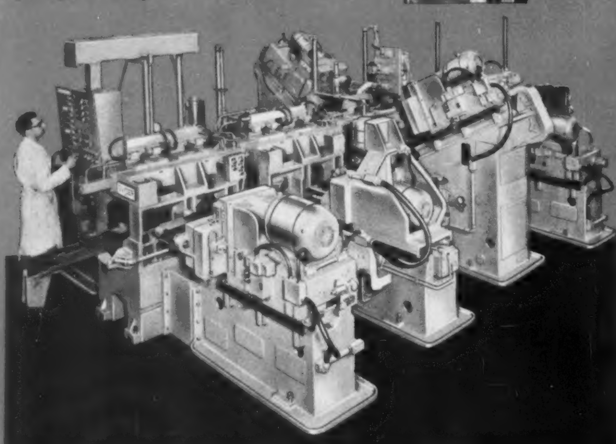
SEGMENT 2: 47 feet long, 31 stations, 91 spindles. In top face, end and at angular locations inside, 51 holes are drilled, countersunk, semi-finish and finish reamed, spot-faced, tapped. Part is tilted 90 degrees and rotated.

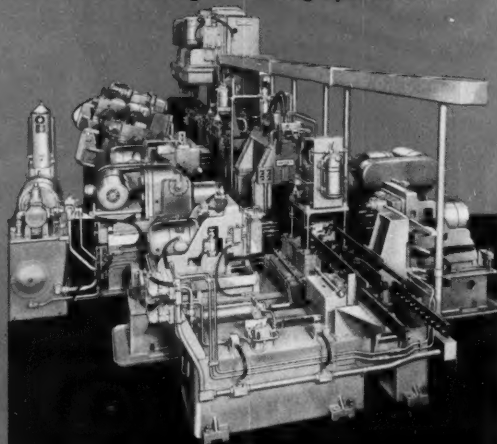


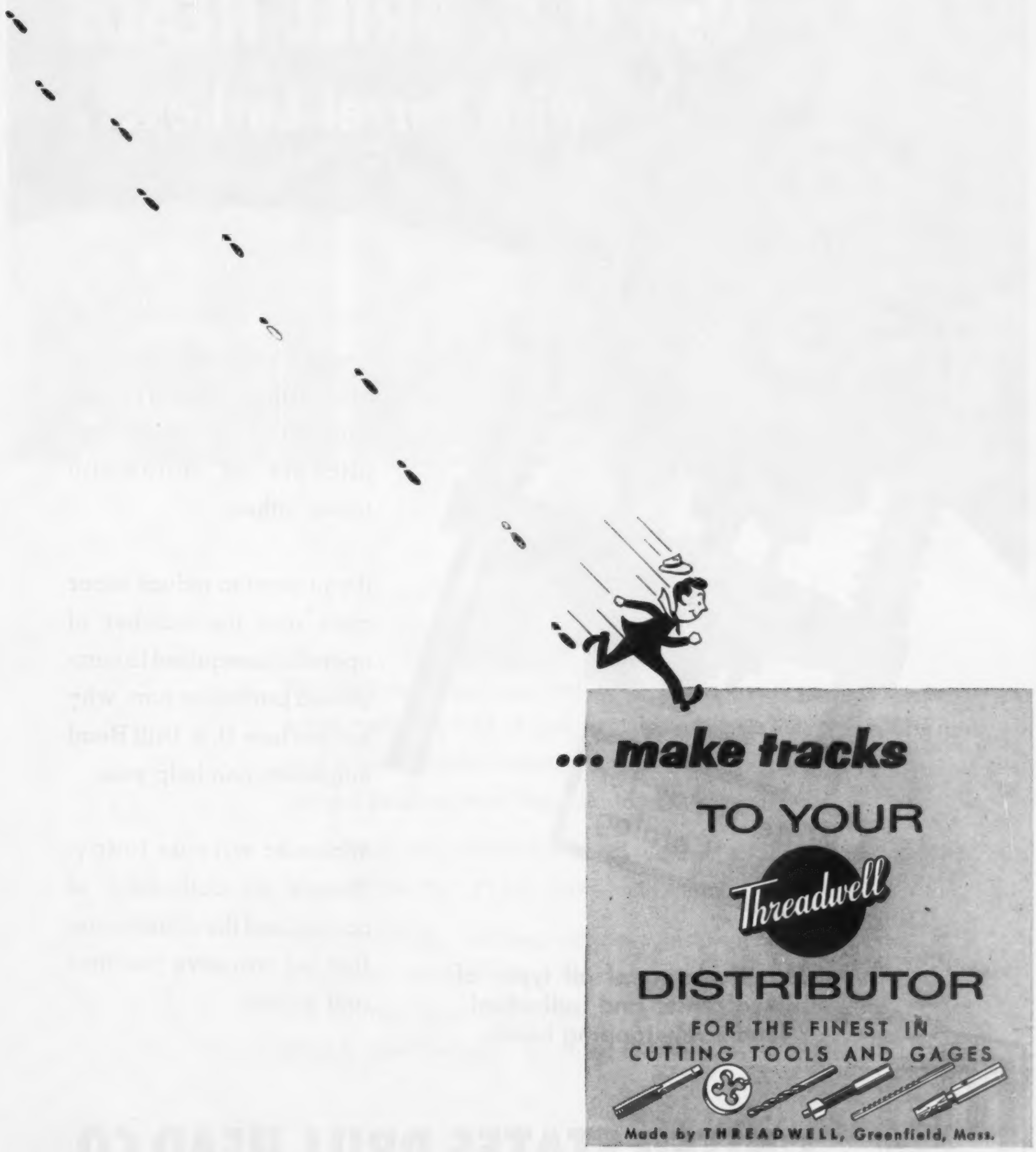


SEGMENT 3: 26 feet long, 17 stations, 21 spindles. Various drilling, chamfering, tapping, counterboring, reaming, spotfacing operations in both case sides. Part removed from transfer bar to special fixture and tipped 45 degrees to process angular inside hole, returned to transfer bar, turned 90 degrees, tilted 90 degrees to bring pump face up.

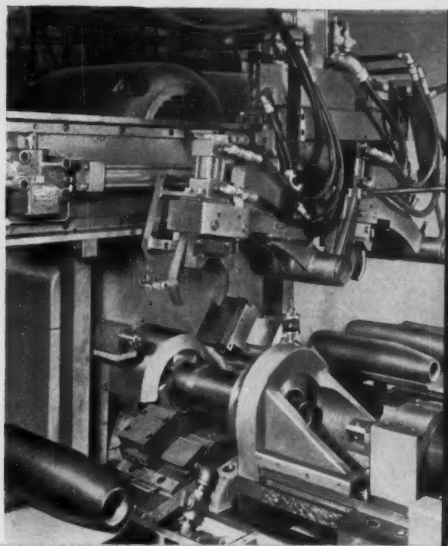
SEGMENT 4: 36 feet long, 24 stations, 60 spindles. Various drilling, chamfering, tapping, semi-finish boring and facing operations.





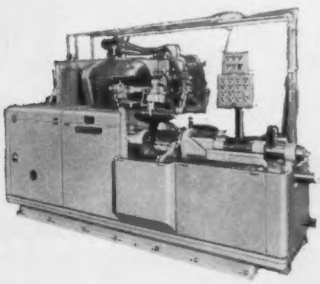


...make tracks
TO YOUR
Threadwell
DISTRIBUTOR
FOR THE FINEST IN
CUTTING TOOLS AND GAGES
Made by THREADWELL, Greenfield, Mass.



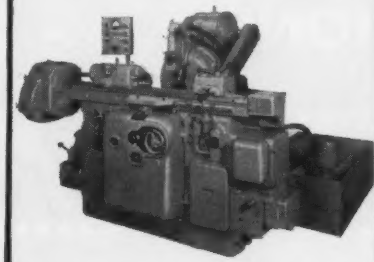
AUTOMATIC HANDLING

Completely automatic operation of this Fay Automatic lathe, including *loading, machining, chip and coolant disposal* and *unloading*, ups production to 180 pcs. per hour at 100% efficiency in the machining of these shells.



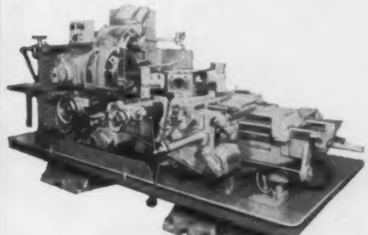
NEW METHODS

By grinding this worm (stock removal .1235″ — one pass) on a J&L 6 x 36″ Automatic Thread Grinder, production is increased 160% per machine over previous methods.



VERSATILE TOOLING

High production methods of tooling for automatic lathes were simplified and applied to three 7B J&L Universal Turret Lathes. Inner and outer Ball Bearing Races are produced on the same machines. Set up time from one lot to the next does not exceed fifteen to twenty minutes per machine.



Jones & Lamson's unique Procurement Plan offers you a choice of methods for procuring new, high-efficiency equipment. You may buy outright; pay-from-productivity on a variety of bases, at interest rates of 3¼% and lower (add-on); or you may use any of several variations of a truly flexible lease plan.

MACHINE TOOL DIVISION

Valuable information is yours for the asking. Simply fill in the coupon below, *clip it to your letterhead*, and mail.

Jones & Lamson Machine Company
512 Clinton St., Dept. 710,
Springfield, Vermont, U. S. A.

Please send me the Jones & Lamson *Machine Tool Replacement Information Kit.*

Name.....................................

Title......................................

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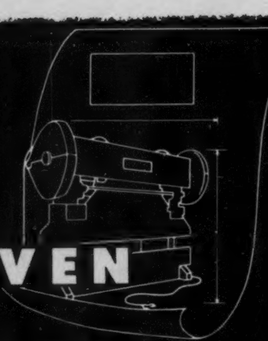
NATCO CUTS
EXAMPLES!
ODD ANGULAR HOLES ARE NO LONGER EXPENSIVE SINGLE OPERATIONS
NATCO DRILLING UNITS
The machining of odd angular holes can be accomplished economically by incorporating single spindle drilling or tapping units in Natco machines or your present machines.
for answers to your Drilling, Boring, Facing and Tapping problems
Call a Natco Field Engineer
CHICAGO, Room 203, 6429 W. North Ave., Oak Park
DETROIT, 10138 W. McNichols Rd.
BUFFALO, 1807 Elmwood Ave.
NEW YORK, 35 Beechwood Ave., Mount Vernon

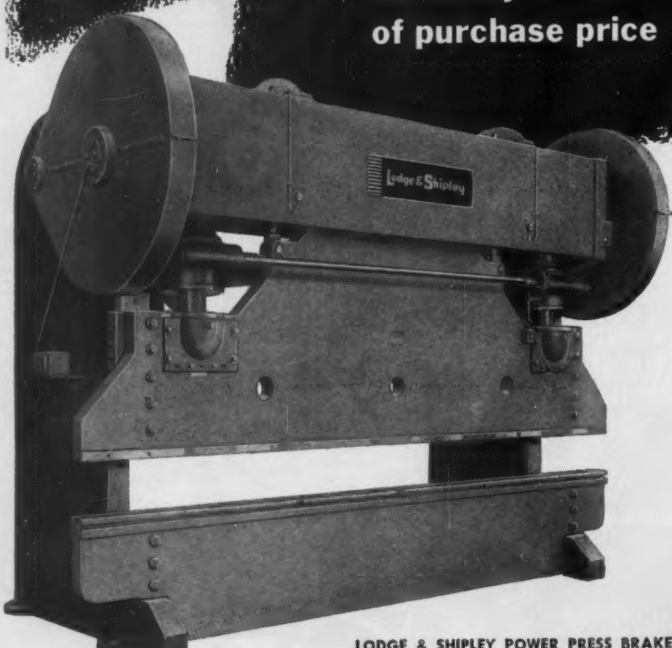


PROVEN DESIGN

PLUS

LODGE & SHIPLEY "KNOW HOW"

gives you a better brake for every dollar of purchase price



LODGE & SHIPLEY POWER PRESS BRAKE
Series 350 Capacities from 8' x 5/8" to 20' x 1/4"

From a background of more than 100 years of experience in building heavy metalworking equipment, Lodge & Shipley is producing power press brakes equal or superior to any other.

Built to Lodge & Shipley standards of strength and accuracy, for long service and minimum maintenance, these power press brakes offer many features which contribute to cost savings.

For example, the air clutch and spring brake is specifically designed for press brake service. The smoothly operating positive clutch is installed in a heavy, balanced flywheel. When the clutch is disengaged, the disc-type friction brake is automatically applied, positively holds the ram in any position.

Give yourself a *better brake,* check the many features of Lodge & Shipley power press brakes against any other power press brake . . . then make your decision.

Write for FREE Bulletin PB-4 and the name of your nearest distributor.

THE **Lodge & Shipley** COMPANY
3057 COLERAIN AVE.
CINCINNATI 25, OHIO

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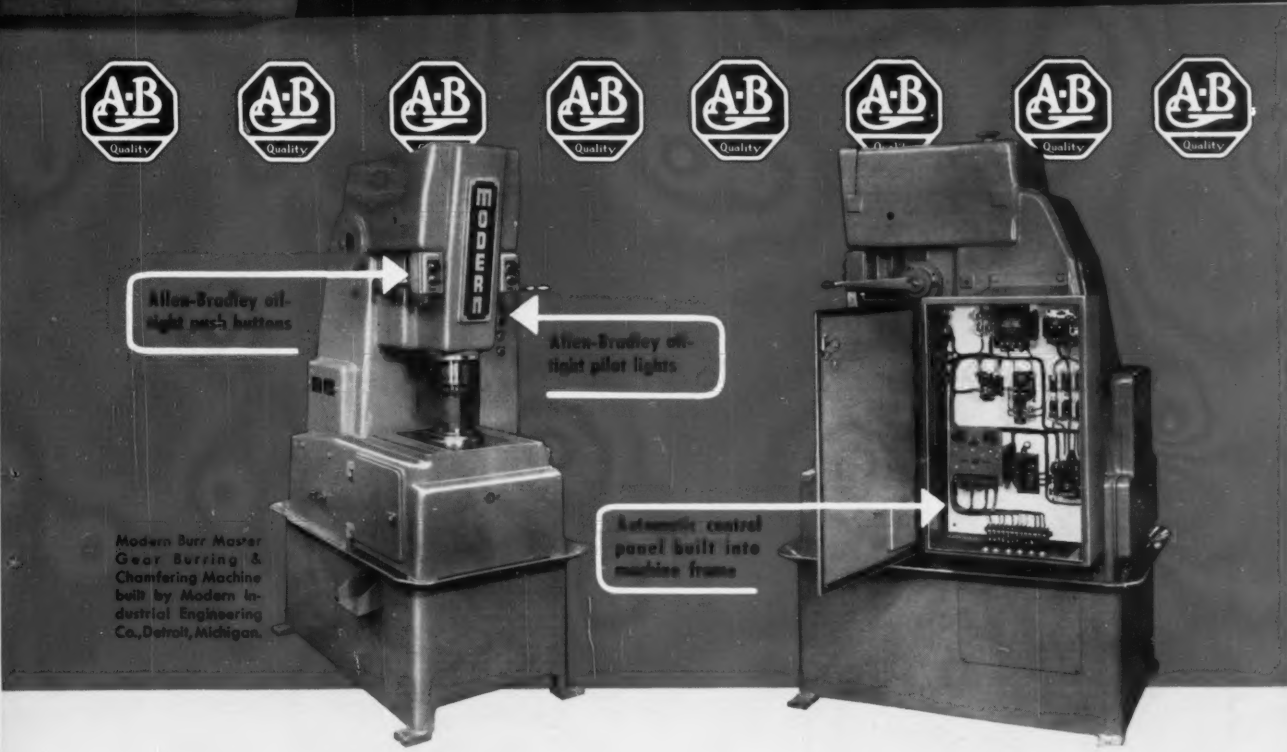
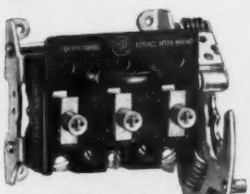
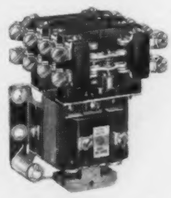


How to Build Trouble Free Automatic Control Panels

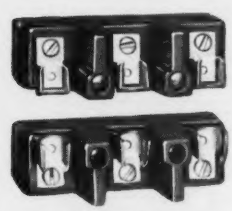
ALLEN-BRADLEY PANEL COMPONENTS



Bulletin 894
Manual Visible Blade Disconnect



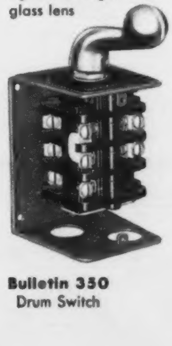
Bulletin 700 Universal Relays up to 8 poles a-c or d-c



Bulletin 891
Adjustable Fuse Clips

Bulletin 800T Oil-tight Pilot Light with glass lens

Bulletin 709
Solenoid Starter

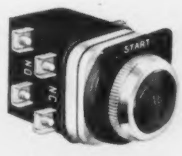


Bulletin 350
Drum Switch

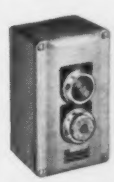
Special control panels—to be reliable and trouble-free—must be built of reliable starters, relays, timers, indicating pilot lights, etc.

When you standardize on the Allen-Bradley line of control components, you get the benefits of years of practical experience with all types of control problems. But, best of all, let Allen-Bradley design and build your trouble free panels for you. Call your nearest Allen-Bradley office for friendly counsel.

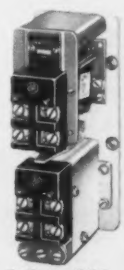
Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd.
Galt, Ont.



Bulletin 800T Oil-tight Push Button



Bulletin 800T Oil-tight Push Buttons



Bulletin 849
Pneumatic Timer

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

10-55-MR

ANTISEP the all-purpose water-soluble cutting base

JUST LIKE MONEY IN THE BANK

... The Savings from **ANTISEP**

How's this for economy? ... Longer tool life, higher quality work, more output per machine and ... all at a cost of 8c per gallon of coolant in the machine!

Aside from the fact that Antisep All-Purpose Base out-performs even the most expensive straight oils, its amazing cost savings astonish metalworking men the most.

Even so, it has other features that make it popular with machinists. Like its anti-welding properties on heavy-duty work, and its antiseptic qualities which eliminate obnoxious odors in the shop.

Ask to see the proof of Antisep's performance in metalworking plants—the Houghton Man has plenty to show you. A test can be arranged at your convenience if you write to Metalworking Research Department, E. F. Houghton & Co., 303 West Lehigh Ave., Philadelphia 33, Pa.

ANTISEP All-Purpose Cutting Base

... a product of

E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service ...

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NEW LeBLOND DUAL DRIVE

best buy for medium duty turning

More than ever before, LeBlond's new 15" Dual Drive lathe gives you efficient capacity at low cost for the great proportion of your lathe work.

With a single lever, the operator commands a smooth and powerful range of 16 spindle speeds from 31 to 2400 rpm. The proven combination gear-belt drive headstock provides twelve gear-driven low and intermediate speeds; 4 high speeds are driven through a positive Gilmer-type belt that requires no adjustment. The 5 hp motor is ample for all work up to that which requires the power of a heavy duty.

The new bed is rigidly ribbed and is fitted with hardened and ground replaceable steel inserts according to LeBlond's compensating veeway principle for better distribution of cutting forces. Chip pan slides in grooves, is easy to clean out. Precision under load is assured by one-piece apron design and long carriage wings with plenty of bearing. Quick-change box is totally enclosed. The tailstock is the same rugged offset-handwheel type used on all LeBlond heavy duties.

All in all, you'll find the new Dual Drive a very fine, yet moderately-priced machine that will take good care of all but the most unusual requirements. See your nearby LeBlond Distributor or write for Bulletin 6D.

. . . cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

LeBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 68 YEARS*

For more information on products advertised, use Inquiry Card, page 231

This is not intended as a joke: the machine tool that was ▶ *paid for* long since may today produce an annual loss equal to its cost of replacement. We know, because Avey equipment has helped many companies to stop losing money on antiques, and make money so fast that the investment was paid for in a year or year and a half. Why?

Because Avey production drilling machines are essentially simple, compact, straightforward in design, built in standard units that fit together to fit your job, and function with standard work-holding fixtures. When a production run is finished, the units are often rearranged for another job, at a fraction of the cost of the original setup, and the owner gets an even bigger bonus of earnings.

Are you really convinced that your drilling operations are now running at top efficiency? Send us your part prints and if we can't be convinced, too, *you stand to gain.* ◀

This Avey machine mills 88 slots in a stainless steel jet engine part--a slot every 40 seconds. Vertically mounted automatic cam feed unit produces desired cycle time. Cutter head can't operate unless automatic indexing table is in correct position. Our advanced Electrodex table makes it easy to change fixture and part quickly with only slight change in indexing mechanism.

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

... in a car that's paid for

Avey

drilling, tapping, production machines

Every Feature Worth a Close, Close Look!

You're Right There! No stretch, no reach, no awkward lifting. Lathe has clean, close front with spindle right under hands.

Why Fight Chips? Bedway design provides chutes to empty chips into open pan at rear of lathe. Simple, practical, time-saving.

Headstock With a Brain! Dial work diameter setting and surface cutting speed setting. Dyna-Shift headstock *automatically calculetes* required spindle speed and shifts to it hydraulically. No mental gymnastics — no compromise speeds!

Two for One. When turning medium steel, 1 cubic inch of metal removal per motor horsepower has been considered good performance. On the Series 80 you can raise that to over 2 cubic inches per motor horsepower.

Support Without a Thought. On longer bed lathes, the leadscrew, feed and control rods are continually supported by traveling carriers that are automatically picked up and dropped off by apron movement.

Infinitely Variable — Infinitely Effective. *Variable speed* four-way hydraulic rapid traverse of carriage and cross slide brings tool to work at the rate of travel you choose—does away with final manual positioning.

For more information on products advertised, use Inquiry Card, page 231

"An adequate and continuing replacement program is vitally important regardless of the size of the plant"

President, Barnes Drill Co.
Rockford, Illinois

"An adequate and continuing replacement program is vitally important regardless of the size of the plant. While the management of medium-sized plants has an opportunity to observe operations and conditions of equipment more closely, we have found that machinery replacement based on factual information and followed by sound judgment has made it possible for us to achieve and maintain higher production, greater precision, and increased product quality."

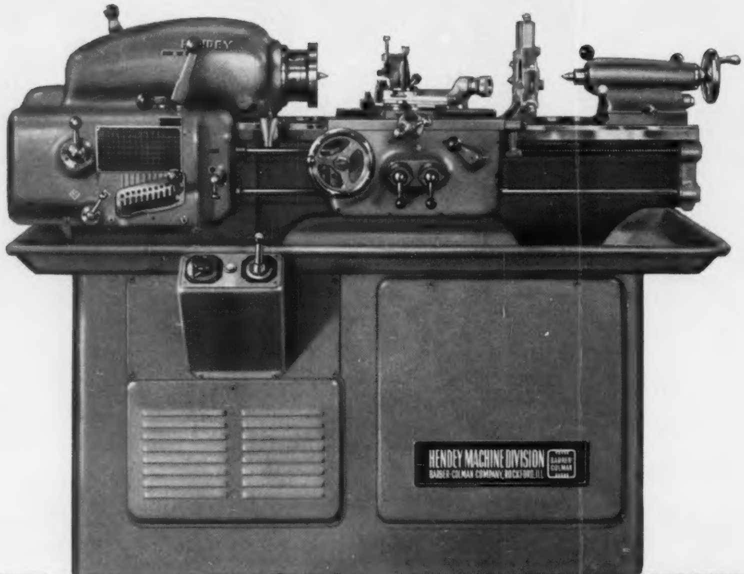
"Elements of competition by both product and method require consistent improvement in precision and efficiency in our machine tools. This can be attained only by making full use of the advanced performance and operating cost advantage of other new machine tools and methods."

"The MAPI formula provides the basis of analysis to identify opportunities for improved performance and cost savings, and enables our management to execute a practical replacement program."

Keep gathering metal-working production ideas . . . be well informed when you replace machinery . . .

Rockford Insert Group

December, 1955



Hendey TOOL AND GAGE-MAKERS LATHE

for precision high speed production

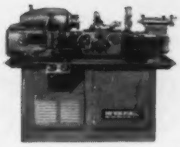
NEW MAGNETIC AMPLIFIER DRIVE UNIT PROVIDES INFINITELY VARIABLE SPEEDS

smoothly and easily changed under load

The Hendey 9" Tool and Gage-Makers Lathe is furnished with a completely new magnetic amplifier drive control as standard equipment. This speed control unit allows a wide range of stepless speeds and a close control of speed under a changing load. The magnetic amplifier unit consists primarily of selinium rectifiers and transformer-type reactor cores. It has no tubes and no moving parts, resulting in exceptionally long service life and practically no maintenance. Previous applications of this type of drive in steel mills, paper mills, etc., have proven its reliability for low-cost maintenance. It replaces the motor-generator unit, providing a more efficient drive and a more sensitive speed control.

TOPS IN ACCURACY . . . HENDEY PRECISION-BUILT

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

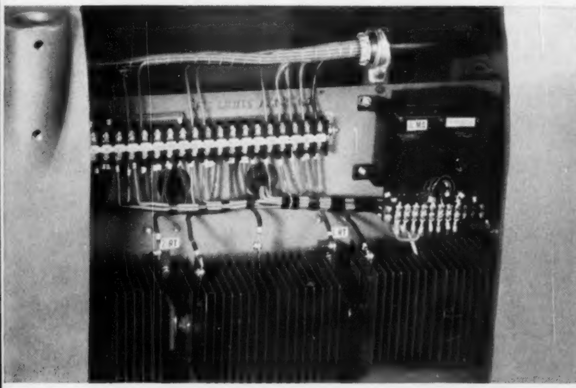


The range of spindle speeds is from 15 RPM to 3000 RPM. No gears are engaged when operating in the belt speed range of 25 RPM to 3000 RPM. The drive from the motor to the spindle is through a multiple V-belt drive. The AC source of power is converted to DC by means of the magnetic amplifier unit.

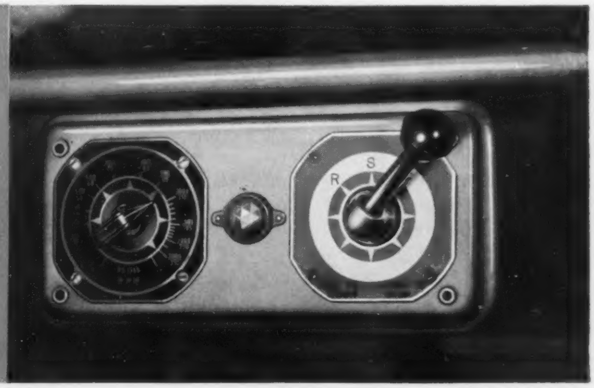
simplified controls

The speed control knob and dial and the Start-Stop and Reverse handle are conveniently located at the operator's left hand. After selecting the desired belt or back gear speed range, simply turn the knob to the required speed as shown on the dial. The control handle is turned for selecting forward or reverse operation of the work spindle. The handle is then pulled for starting, and depressed for stopping the drive motor. The knob and handle control the spindle speed, the direction of spindle rotation, and starting and stopping the machine.

Section of Magnetic Amplifier Unit



Speed Control Knob and Dial



other features

Other features of the Hendey 9" Lathe include:
66 quick-change thread cutting and feed changes
Pre-loaded, super-precision, anti-friction spindle bearings
Hardened and ground bed ways
Precision lead screw
Feed shaft independent of lead screw
10¼" swing over ways — 24" centerdistance

MACHINE TOOLS *Hendey* machine division
BARBER-COLMAN COMPANY
211 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

cut *Finishing* costs

THROUGH HIGH PRODUCTION-PRECISION CONTROL

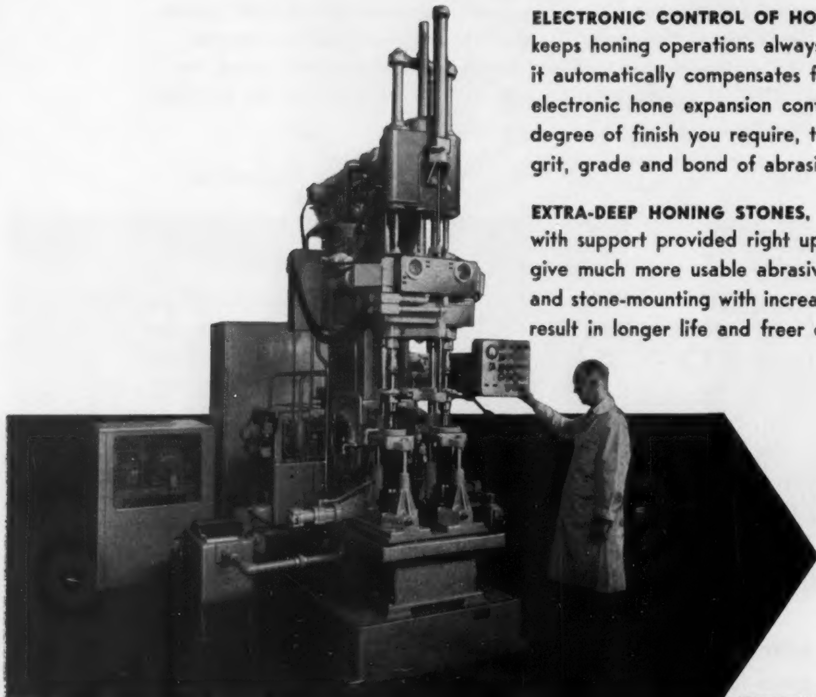
using

BARNESDRIL

PLUGMATIC SIZING
works automatically to give bore-to-bore size control over every piece honed, making each interchangeable with the others. Sizing is not affected by misalignment or eccentric stone wear.

ELECTRONIC CONTROL OF HONE EXPANSION
keeps honing operations always at peak efficiency because it automatically compensates for stone wear. With electronic hone expansion control, you can select any degree of finish you require, through proper rate of feed, grit, grade and bond of abrasive stone.

EXTRA-DEEP HONING STONES,
with support provided right up to the cutting edge, give much more usable abrasive. Improved body design and stone-mounting with increased cutting edge support, result in longer life and freer cutting action.



No. 307
VERTICAL HONING MACHINE
Job Specifications:
Steel Hydraulic Cylinders
Bore — 3.000" I.D. x 10½" length
.012"/.017" stock removed
Bore Sizing — within .0005"
Finish — 25 R.M.S.
34 pieces per hour

No. 38
HORIZONTAL HONING MACHINE
Job Specifications:
Steel Tubes
Bore — 1.500" I.D. x 10 ft. length
.012"/.016" stock removed
Bore Sizing — within .0005"

DETROIT OFFICE
3419 South Telegraph Road
Dearborn, Mich.

HOLE BARNESDRIL FINISHING

send for complete catalog bulletin 5005

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

GREENLEE

special-purpose machines for profitable mass production

Master brake cylinder machined on above Greenlee Special Machine.

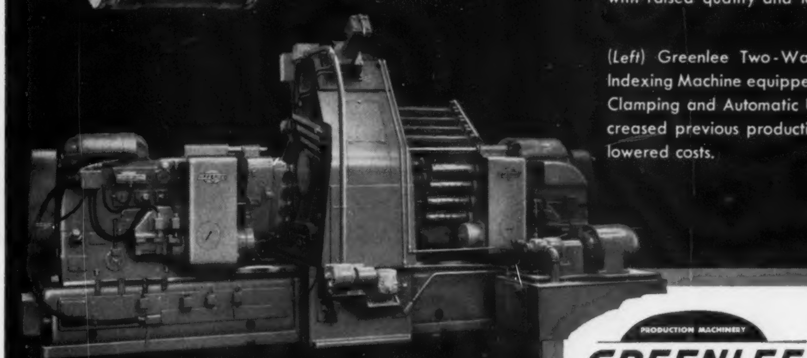
THEY SAVE WORK...THEY SAVE MONEY

If you are being outdistanced in today's swift race for production...faced with narrowing profit margins...it will pay to investigate Greenlee Special Machines. Savings effected on drilling, reaming, boring, counterboring and tapping operations will quickly amortize your invested dollars.

Wheel cylinder machined on Greenlee Special Machine shown below.

(*Above*) Greenlee Horizontal Indexing Machine designed for processing master brake cylinders has proved itself with raised quality and lowered costs.

(*Left*) Greenlee Two-Way Horizontal Indexing Machine equipped with Power Clamping and Automatic Unloading increased previous production rates and lowered costs.



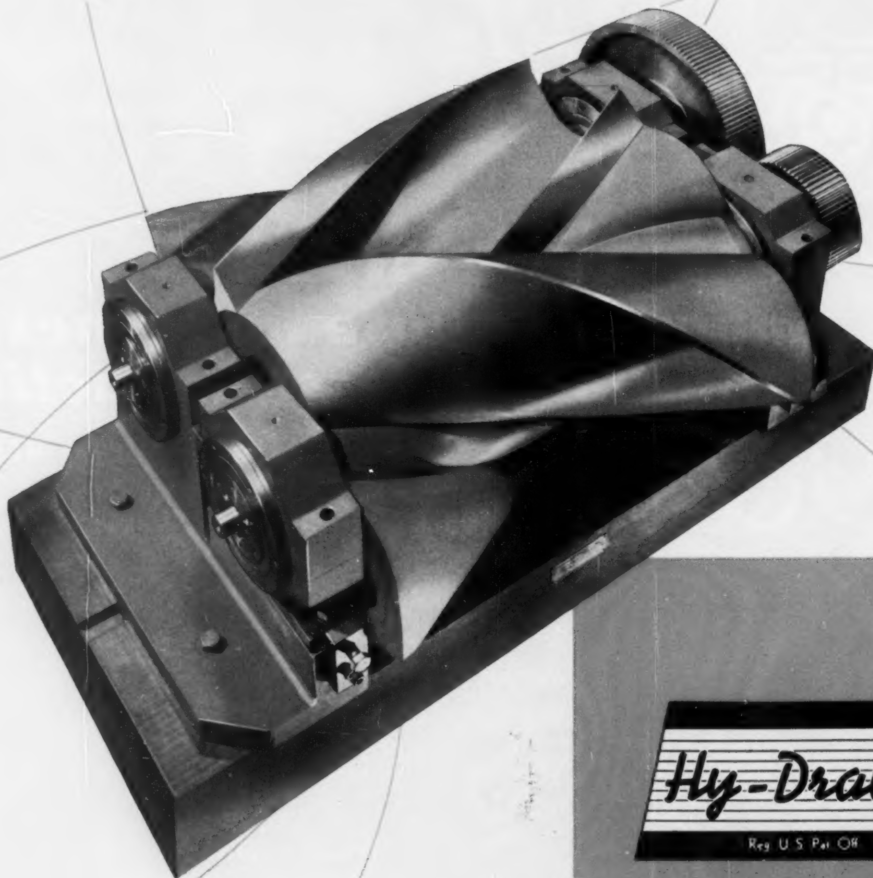
WRITE FOR COMPLETE INFORMATION

PRODUCTION MACHINERY GREENLEE

GREENLEE BROS. & CO.
1872 MASON AVENUE
ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

extremely difficult job???



Hy-Draulic
Reg. U.S. Pat. Off.

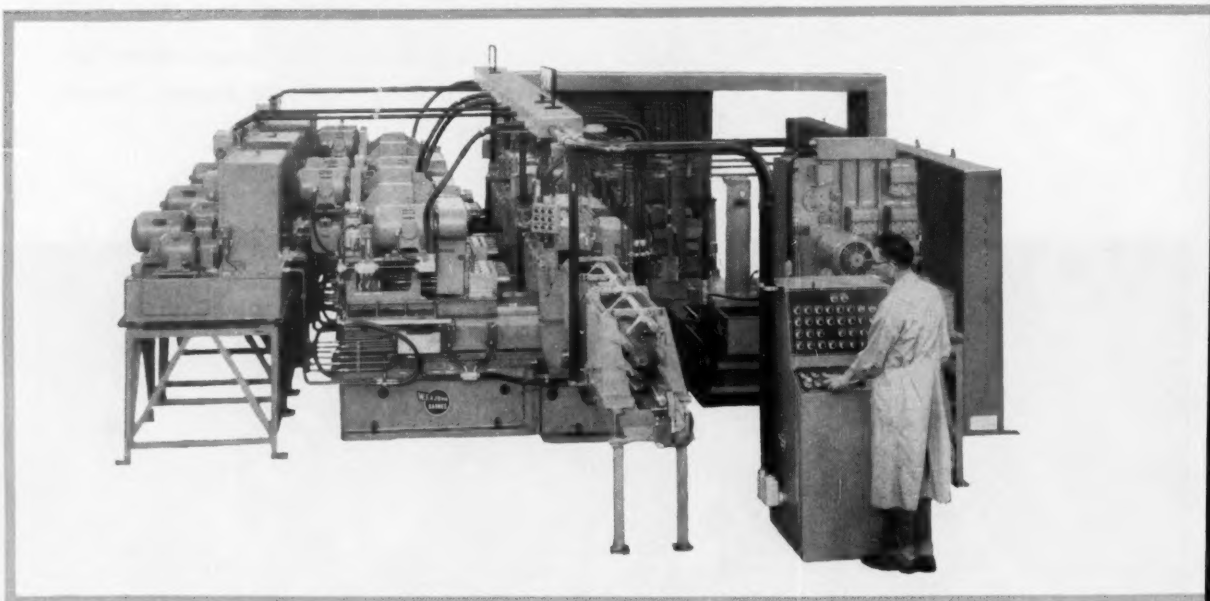
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

A PART OF

PACKARD'S

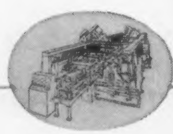
NEW MANUFACTURING FACILITIES

★The three examples shown here are representative of the many machines built by W. F. & John Barnes for Packard. Each represents a profitable solution to the problem of saving time and cutting costs. All have been especially engineered to meet a specific production problem. Whether your production requires large or small machines, you'll find that designing and engineering are coordinated at Barnes to provide a complete machine tool building service from one convenient source. Write for more facts today.

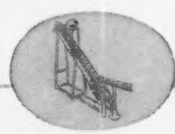


SPECIAL AUTOMATIC BORING MACHINE— Finish machines V-8 cylinder head valve seats and stem holes. Corrective operations after boring, reaming, and seating operations are eliminated by holding total concentricity within .0005" (total indicator reading).

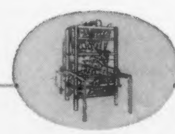
W. F. & JOHN BARNES



Special Machine Tools



Special Conveyor Units



Special Process Equipment

MULTIPLE SPINDLE DRILLING • BORING • TAPPING MACHINES

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

...designed for *quick* set-ups to handle small lots

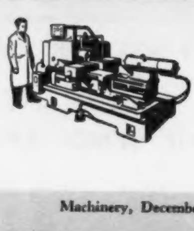
This Sundstrand 40 HP single point turning lathe provides a ruff and semi-finish cut with ruffing tool and finish cut with finishing tool *all in one automatic cycle.* This is a mechanically operated machine with front carriage and shoulder facing tools actuated independently. Three cuts, as described, can be taken on each of 8 diameters at 4 different speeds in one automatic cycle. No template is required for step turning, and

SUNDSTRAND

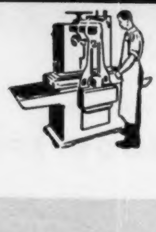
50 YEARS OF "Engineered Production Service"*

*REG. U.S. PAT. OFF

AUTOMATIC LATHES



SIMPLEX RIGIDMILS



DUPLEX RIGIDMILS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

micrometer adjustment for steps is easy to set for size corrections due to material changes, etc. There is no lost motion for re-set because index takes place during cut.

Machine is provided with a transmission type head with automatic speed changes to maintain correct speeds and maximum horsepower. Feeds are infinitely variable, from $7\frac{1}{2}$ to 300 inches per minute.

also available with PUNCH CARD control

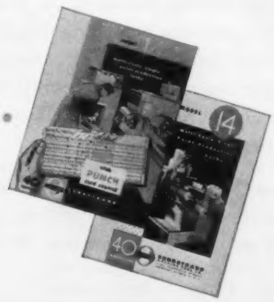
Check these 7 important advantages

1. Easy tool maintenance.
2. No matching of cuts.
3. Fast set-up.
4. Uniform stock removal for subsequent grinding or finishing operations.
5. Ruff and finish automatic cycle for possible elimination of green grinding.
6. No waiting for special tooling to complete small lots.
7. No tooling inventory for small lot runs.

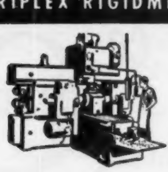
This same machine can be furnished with punch card control. With this system, decimal dimensions on engineering drawings are punched in standard business machine cards with a standard key punch. The cards are then fed into a reader, as shown above, which feeds the electrical signals into a machine control unit. This unit then controls all functions of the machine.

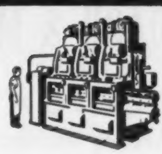
Additional Data

. . . on both types of machines is available. Write for copies today. Ask for bulletin 662.



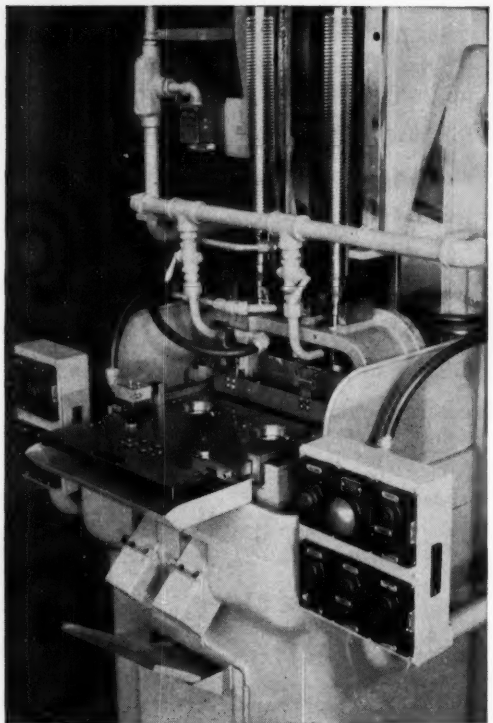
TRIPLEX RIGIDMILS | SPECIAL MACHINES

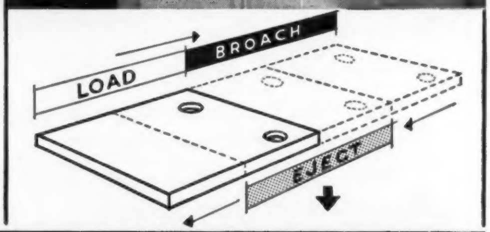




SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**





Another *American* First

45 GEAR TEETH BROACHED IN 360 RING GEARS PER HOUR

Here, an American 3-Way, pull-down broaching machine broaches 45 teeth in the ring gear for a two-speed bicycle transmission — two gears with each pass, 360 pieces per hour. A two-station fixture mounted on a 3-position hydraulic slide moves the parts into broaching position. The parts are broached after which the slide moves back, automatically ejecting the parts. The operator reloads while the broaches return. The machine can be run on automatic cycle. The operator only has to feed parts to the fixture.

American 3-Way Broaching Machines can be supplied with either electrical or manual controls, with fixtures and broaches designed to your requirements. Write for Catalog No. 101.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

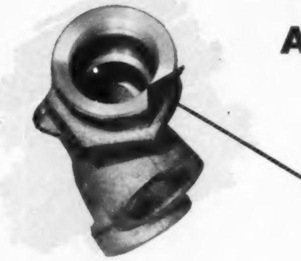
See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

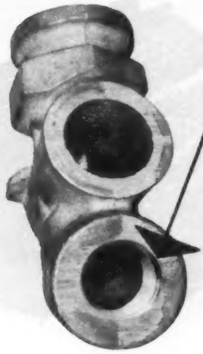
MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.

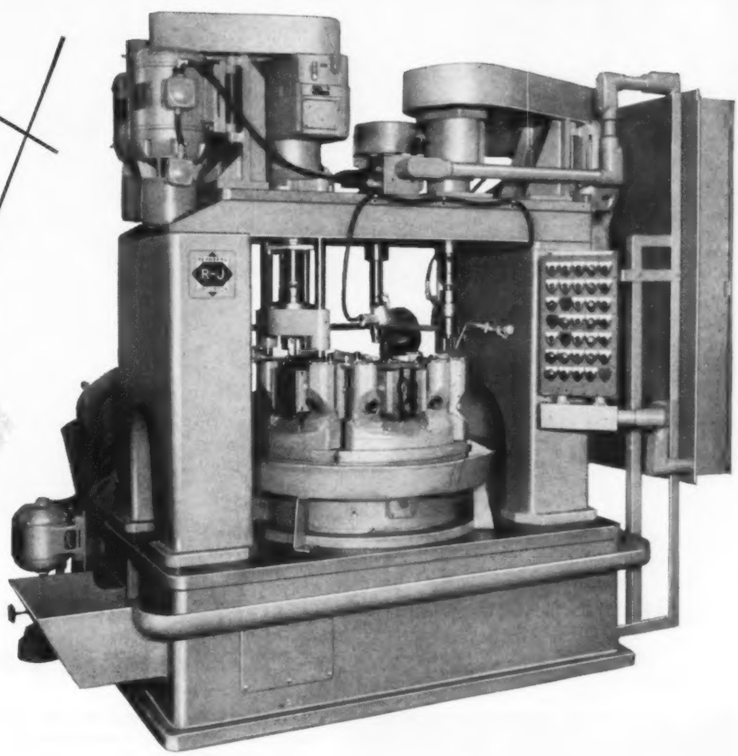
REHNBERG-JACOBSON

Shows the way to...

BORE, CHAMFER, UNDERCUT and TAP A BIG ANGLE COCK







Two views of this husky railway air valve are shown above. The top view looks down into the upper hole, where most of the machining is done, as described below. This hole has three stepped diameters, two chamfers, a facing operation, and an undercut. The lower hole, shown in the bottom view, is a standard 1¼" pipe thread at 60° from the vertical axis.

"Built Like a Little Brick Church"...

The purchaser of this Rehnberg-Jacobson 5-Station *Bridge-Type* Automatic Index machine likes it because it has a lot of extra "beef" in it. This ruggedness is necessary, because the big air cock it machines is used in heavy railway service. Castings are held in equalizing jaws operated mechanically by an air-driven impact tool. From the top, the piece is (a) combination bored, faced, and chamfered on 3 diameters simultaneously, (b) finish bored on the same three diameters, (c) undercut and chamfered for a sealing member, and (d) tapped 2-1/8"–16 special. During the same sequence, two angular units move in to core drill and tap 1-1/4" NPT the lower hole. All units, including the 36" 5-position Index Table, are *all-mechanical* R-J products. Capacity is rated at 106 pieces per hour. *This machine, like many others we have designed and built, is easily adaptable for machining other sizes or models of similar valve bodies.*

Designers and Builders of Special Machinery

REHNBERG-JACOBSON MANUFACTURING COMPANY

REHNBERG R-J JACOBSON

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

CASE HISTORY NO. 11—CONNECTING RODS AND CAPS

MATTISON HIGH-POWERED PRECISION

GRINDING METHODS

Grinds two sides of connecting rods and caps at rate of 375 each, per hour

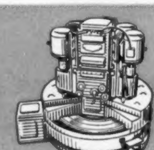
Four high-powered spindles progressively finish rough forgings to close tolerances.

Machining flat surfaces at high speed and low cost is the most important single advantage of using the Mattison No. 72 Rotary Automatic Grinder. In this application, a four spindle No. 72 does continuous, single-pass grinding of two sides on automotive connecting rods and caps at a production rate of 375 each, per hour. Because of this high production rate, it was necessary to set up automatic cam-actuated clamping and unclamping devices. The operator merely loads and unloads pieces without stopping the machine.

Centralized automatic feeds simplify control, save inspection time, and minimize nonproductive machine time. An automatic feed mechanism operates the wheel feed screws to compensate for wheel wear as gauged by work sizers. When pieceparts approach their high limit, the machine feeds down a predetermined amount from .0001 to .001 in. Accuracy of feed is within .0001 in.

The No. 72 Rotary Automatic has the high horsepower required to take advantage of today's improved grinding wheels, and provide fast stock removal and free-cutting action on a wide range of work. Bulletin No. 147-2 tells the complete production story of this grinder.

IF IT'S A FLAT SURFACE THERE IS A MATTISON TO GRIND IT



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 12—LAMINATION DIES

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

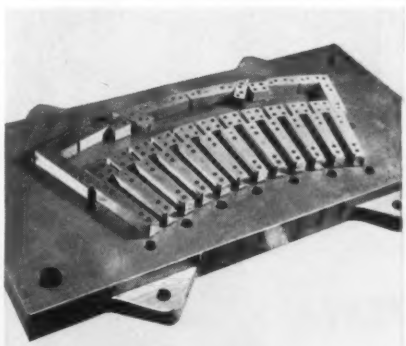
Precision die sharpening shows versatility of this production surface grinder

Precision surface grinding at feed rates measured in "tenths" with fine finish, or heavy stock removal at high speed can be done equally well on the Mattison High-Powered Precision Surface Grinder. Shown above is one of these units at work sharpening male and female dies used to cut laminations for generators by a large manufacturer of electric motors.

These dies are held by a magnetic chuck during grinding. Down feed is set at .0005 in. and parallelism is closely held on the finished dies. Material is Neor die steel. Production was increased markedly and finish much improved when the Mattison grinder was put into operation. User is pleased with the machine, saying that in addition to the production increase and improved finish, it is easy to control and operate and offers great accuracy.

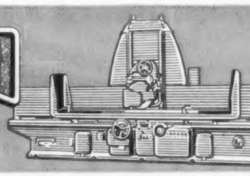
This high-powered, ruggedly constructed grinder can be adapted to a variety of jobs beyond straight flat grinding. Large sized castings can be handled easily to permit grinding surfaces that were handscraped previously. Flat and V-type ways, as well as contour work, can be ground with a wheel dressed to the proper shape.

Send for Bulletin "HP."



Male stator die sharpened on Mattison High-Powered Precision Surface Grinder.

MATTISON
MACHINE WORKS
ROCKFORD, ILL. U.S.A.

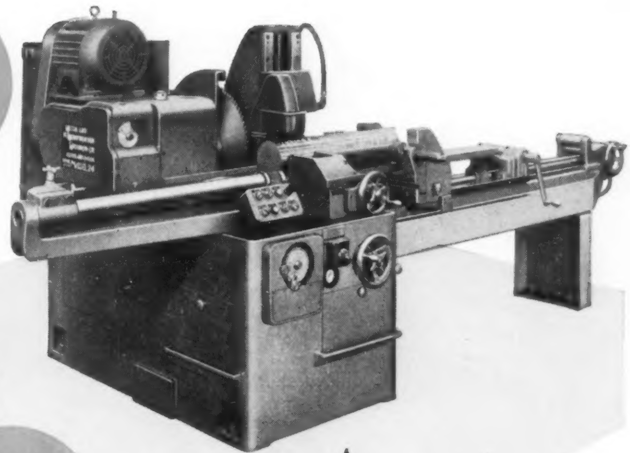


HIGH-POWERED PRECISION SURFACE GRINDERS

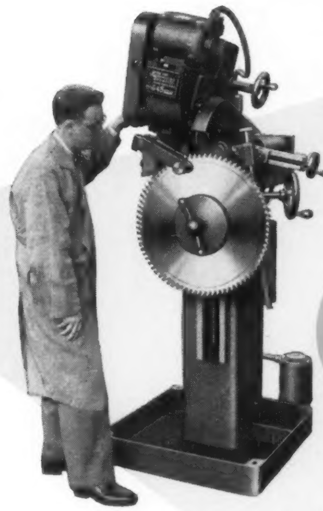
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

THE Triple-Chip METHOD IS A *Triple-threat* TO HIGH CUTTING COSTS

CIRCULAR SAWING MACHINES



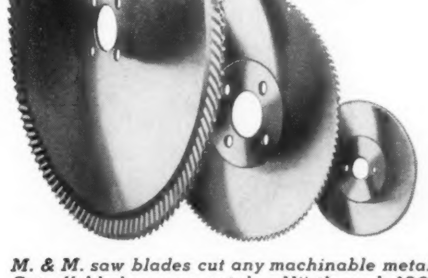
SAW BLADE SHARPENERS



The No. 2-8 machine for cutting off solid metal up to 8" square.

The G-45 sharpener for blades 8" through 48" diameter.

SAW BLADES



M. & M. saw blades cut any machinable metal. Cut-off blades: segmental — 11" through 120" diameter; solid — 8" through 20" diameter. Slitting saws — 3" through 8" diameter.

You may profit immensely by applying the M. & M. Triple Threat to *your* cut-off costs. Machine, blade, and grinder, made by the first company to build all 3, often effect phenomenal savings, as proved by detailed case studies. *Just such a study of your job is yours for the asking.* We offer you an unmatched experience in the sawing of any machinable metal, round, square or structural shapes, from 1/4" through 43" diameter.

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders also of Production Milling, Vertical Turning, Automatic and Special Machines

For more information on products advertised, use Inquiry Card, page 231

people at the machine

tool show compared

. . . AND SAW WHY

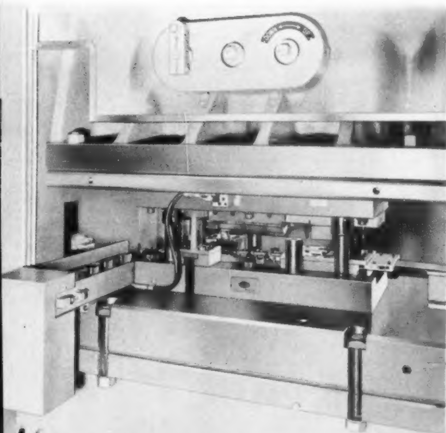
IT COSTS LESS TO RUN A DANLY PRESS

Manufacturers, engineers, machine tool users and industrial leaders from all parts of the world watched Danly Presses and equipment operate at the Machine Tool Show in Chicago. They saw working demonstrations of Danly operational features . . . inspected advanced Danly design and construction . . . found out first-hand *why* increased production costs less with Danly Presses.

The Danly Autofeed Press exhibited represents the most advanced thinking in high-speed stamping press design . . . duplicating the actual results *you* can expect in your own plant. Vibration-resistant construction. built-in press controls, operator and press safety devices built into this press result in direct savings in maintenance and operating costs. Machine tool precision and substantially heavier construction throughout are basic reasons why Danly Autofeed Presses will give you greater production from your progressive dies . . . why this exhibition press turned out stampings from a seven station die at the rate of over 3,000,000 per month. This figure represents the number of rifle clips actually being produced, month after month, in a production plant from an identical die on a similar Autofeed Press.

These same Danly advantages will produce substantial savings in your operations. Use the comparison list shown here to check Danly Presses, feature for feature, against all other presses. *Discover for yourself why Danly Presses mean* increased production at lower operating costs. Talk to a Danly engineer *soon*. *Write for the completely new Danly Autofeed Press Catalog now!*

WHY DON'T YOU COMPARE DANLY PRESSES, FEATURE FOR FEATURE, WITH ALL OTHER PRESSES ON THE MARKET?

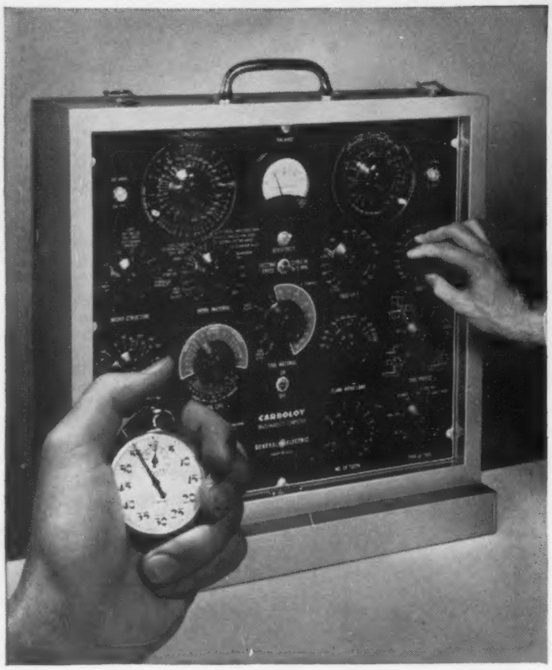


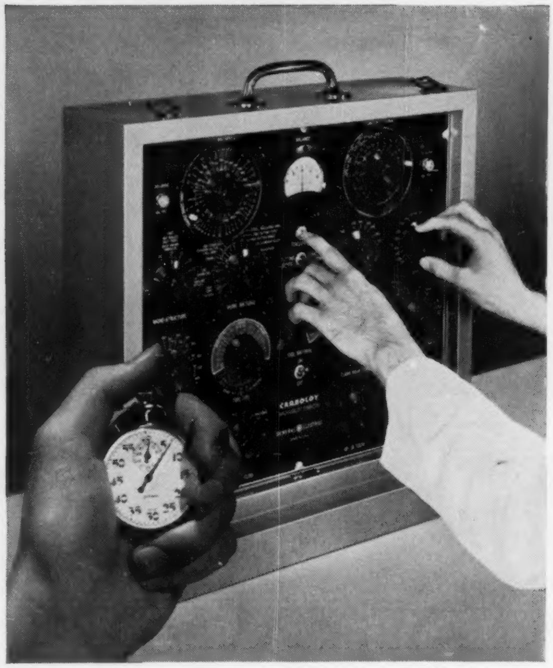
THIS IS THE SEVEN STAGE PROGRESSIVE DIE THAT PRODUCES RIFLE CLIPS AT THE RATE OF OVER 3,000,000 A MONTH. EXTREMELY CLOSE ALIGNMENT OF OIL LUBRICATED SLIDE GIBS AND EXTRA-RIGID CONSTRUCTION OF DANLY PRESSES PROTECT DIES SUCH AS THIS, ASSURING LONGER LIFE.

COMPARE	FEATURE	DANLY	OTHER
PRECISION	Machine tool precision in manufacture and assembly plus adequate lubrication assure smoother operation, longer life.	✓	
INSTALLATION COSTS	Danly presses are delivered already "run-in" tested. Assembly and operation in the Danly plant means fewer adjustments, faster installation.	✓	
DRIVE	Danly's cool-running clutch lasts longer. Herringbone type gears and anti-friction bearings on high speed shafts wear longer.	✓	
CONSTRUCTION	Extra-heavy construction reduces vibration and deflection. Dies last longer, presses stand up under severest duty.	✓	
LUBRICATION	Danly features completely automatic oil lubrication including slide gibs. Should any vital bearing not be sufficiently lubricated, safety switch stops press and indicates the source of trouble.	✓	
MAINTENANCE	Performance records in the country's biggest stamping shops prove that Danly Presses require less maintenance, greatly reduce spare part needs.	✓	
CONTROLS	Controls designed and built by the press manufacturer assure the user of undivided, one-source responsibility for control and press performance on the production line.	✓	

DANLY®

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue · Chicago 50, Illinois





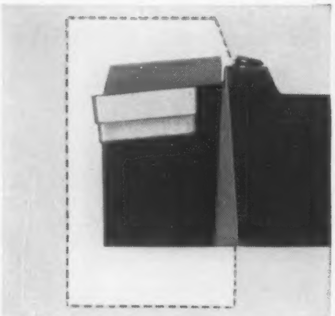
SOLVE MACHINING PROBLEMS IN SECONDS

The Carboloy Machinability Computer can determine the most efficient values for any of these 19 basic operating variables:

Material to be cut: Work material, microstructure, hardness, surface condition.

Cutting tool: Tool material, tool life, flank wear land, tool profile, type of tool, number of teeth.

Cutting conditions: Cutting fluids, feed, depth of cut, cutting speed, motor horsepower, cubic inches per minute, unit horsepower, work diameter, R.P.M.



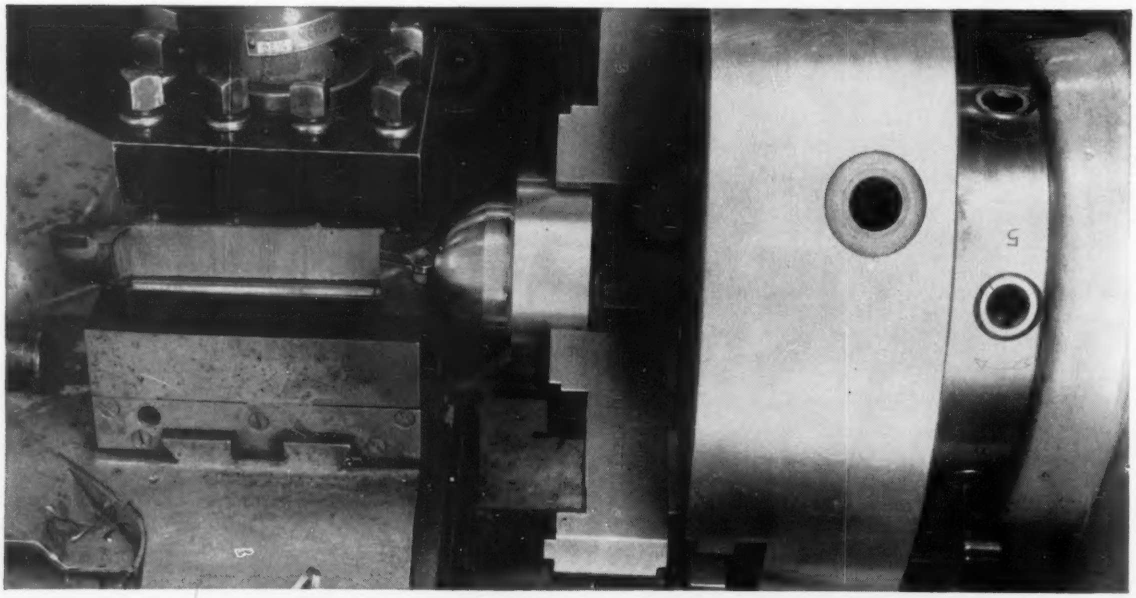
New design eliminates "club" below shank; reduces overhang to absolute minimum. Indexing is fast, simple . . . accuracy is increased.

Clamp has built-in, wear-resistant carbide chipbreaker. Requires only light finger pressure to tighten; assures uniform chips on any cut.

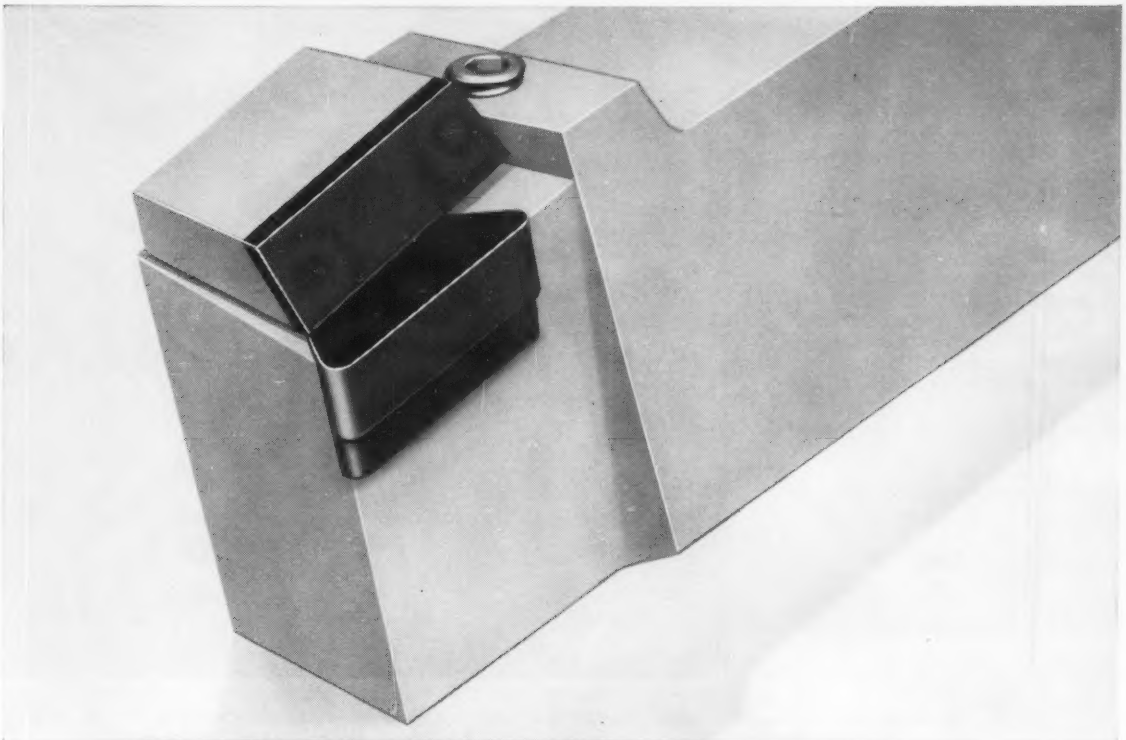
Indexable carbide pad is screwed to shank. Stays put while blank is indexed. Absorbs shock; decreases the possibility of holder damage.

Because they combine four basic design improvements . . .

NEW CARBOLOY TOOLHOLDERS ARE EASIER



Contouring Stellite valve. Round Carboloy cemented carbide insert is furnished precision-ground, eliminating costly grinding operation required for braze-type tools. Inserts on new Carboloy toolholder are indexed or turned over right in the machine . . . reducing downtime. With Carboloy holders, only inserts are stocked . . . saving valuable toolroom space.



TO USE . . . STRONG, SIMPLE, AND ACCURATE

- **Single screw indexes insert; automatically sets chipbreaker**
- **Carbide pad absorbs shocks; cuts throw-away insert costs**
- **New design reduces overhang; improves tool accuracy**
- **Heat-treated shanks resist bending and deformation**

Simply adjust a single screw at the top of the shank, and the cutting blank can be indexed or turned over while the Carboloy holder stays in the machine. The carbide chipbreaker is set automatically in the correct position.

Carbide pad cuts insert costs

Because the carbide pad absorbs shocks and gives greater rigidity, thinner, harder, more economical cutting blanks can be used. Machines operate at greater speeds and feeds; increase output at reduced cost.

Carboloy design eliminates projections below the shank . . . reduces overhang, increases accuracy and rigidity. Minimum projection above the shank stops chip interference, protects clamp from abrasive chips.

Heat-treated shanks give the holders extra strength to resist clamp-screw deformation and chip wear.

Handle special jobs with ease

The Carboloy holder design is quickly adaptable to "specials" with cutting angles other than standard, and to positive or neutral rakes. New, compact design makes them especially efficient for gang tooling.

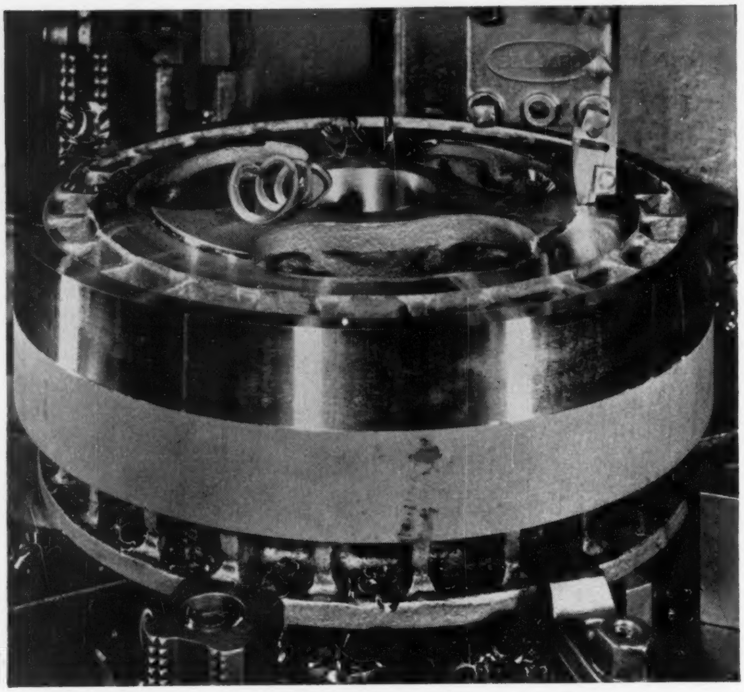
Available for round, square, or triangular blanks, the Carboloy holders are stocked in seven styles and 52 sizes. New, heavy-duty holders are also available. For prices and specifications, send in the coupon on page 8 of this advertisement.

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

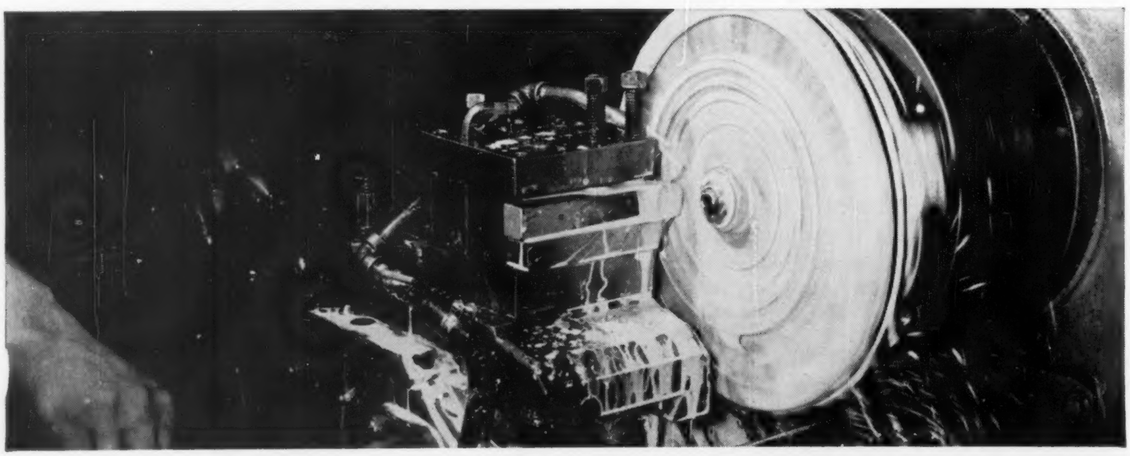
FACING POWER-SHOVEL CLUTCH AND BRAKE DRUM. It took as many as 16 of the former carbide tools, on a 42-inch Bullard, to make a *single* cut through multiple sand inclusions and heavy interruptions. A Grade 370 tool took *nine* cuts without any appreciable wear. Because the Grade 370 tool outlasted 144 of the previous tools, over-all machining costs were cut almost 70%, downtime costs were reduced from $60 to $1, and grinding was completely eliminated.

SETUP: Material—1045 low carbon, high manganese cast steel, with hardness of 27 R_c. **Speed** – 24 RPM. **Feed** – 0.018-0.033 inch. **Depth of cut** – 3/8 inch. **Coolant** – No.



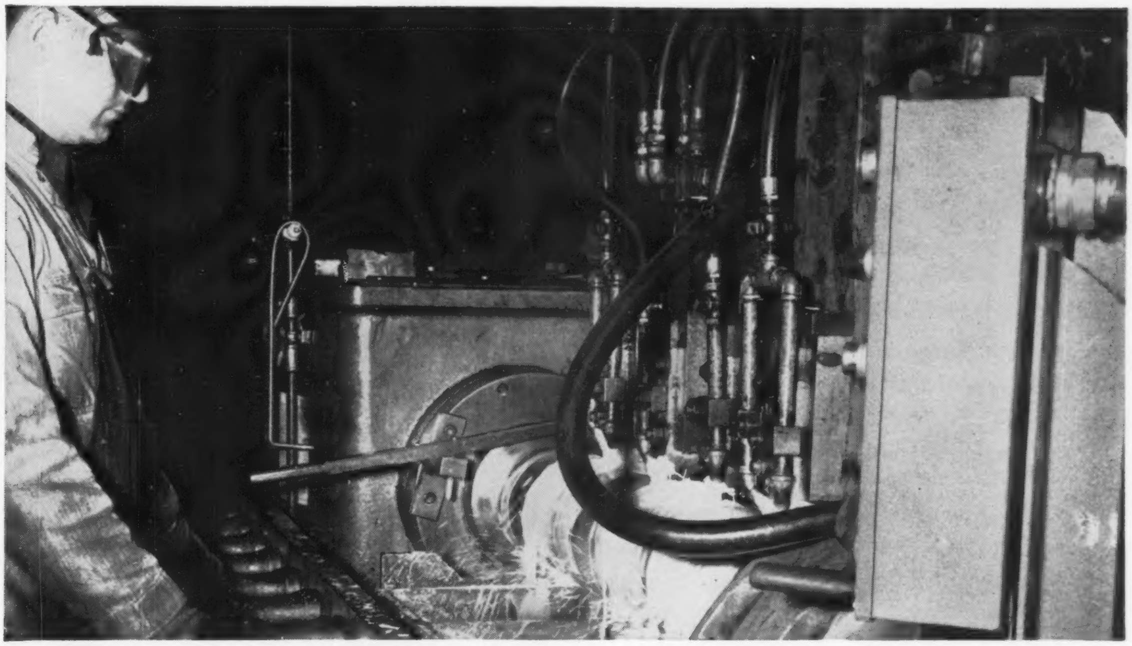
Hundreds of in-plant case histories prove . . .

CARBOLOY GRADES 350 AND 370 CUT FASTER,



FACING TURBINE WHEEL BUCKET. It took 60 carbide tools, making two separate cuts, to get daily production of 25 units at Kelsey-Hayes Wheel Co. By switching to Grade 370, the two-cut operation was compressed into one, the number of tools required was reduced two thirds, and production was almost doubled.

SETUP: Material – Inconel, heat-treated to 18 R_c, welded to rim of Stellite. **Speed** – 125 sfpm. **Feed** – 0.0155 inch. **Depth of cut** – 3/8 inch. **Coolant** – Yes.



TURNING 8-INCH STEEL SHELL. Grade 350 increased production runs on these forged and extruded shells between 15 and 20 pieces per grind. At toughest stage of rough-turning operation, Grade 350 processed 4 times as many shells as other carbides.

SETUP: **Material** – 1045 steel with varying heat analysis. **Speed** – 302 sfpm. **Feed** – 0.044 inch. **Depth of cut** – 3/16 to 7/16 inch. **Coolant** – No.

WEAR LONGER, GREATLY INCREASE OUTPUT

▶ Outperform all other steel-cutting carbides

▶ Take heavier, deeper cuts without deformation

The machining records in plant after plant show Carboloy Grades 350 and 370 are capable of increasing output up to 300% over previous carbides used.

Not only do these grades outperform conventional carbides at higher speeds and feeds, but they outwear them on the toughest jobs – in some instances by margins as high as 144 to 1. (See case history above at left.)

Built-in structural rigidity

Carboloy Grades 350 and 370 are extra-performance carbides. Their superiority is due to the greater structural rigidity built-in by the Carboloy manufacturing process.

This process enables them to take deep, punishing cuts without the chipping, cracking, or cratering encountered in other carbides . . . even at temperatures as high as 1800° F.

No "equivalent grades"

Try heavy-duty Grade 370 and medium-duty Grade 350 in your own plant . . . compare them with regular tools on your toughest jobs. You'll quickly see why there are no "equivalent grades" to Carboloy 350 and 370.

Your local Authorized Carboloy Distributor stocks a complete line of Grade 350 and 370 tools, blanks, and inserts. Contact him today; or for more information on these extra-performance carbides, send in the coupon on page 8 of this advertisement.

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

For more information on products advertised, use Inquiry Card, page 231

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation | BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. | Export Distributor: Bethlehem Steel Export Corporation

Notching Die Made of Bearcat Gives 7 Times Greater Output

An interesting item being manufactured in the southeastern part of the country is a windshield garnish molding for a popular make of automobile. The molding is produced from cold-rolled steel, 0.020 in. thick. It is formed by a notching die, hardened to Rockwell C 56-58.

With the grades of shock-resisting tool steel formerly used for the die, a maximum of 1400 pieces was produced before breakage occurred. Because of the severity of the application, this was considered good production even though it necessitated a change of die about five times daily.

After studying the operation, we suggested a change to Bearcat tool steel. "Bearcat is a super shock-resisting grade," we said. "We're sure it will last longer in a tough job like this, and so save you money. Why don't you give it a try?"

So Bearcat was put to work. The dies made of Bearcat have been giving a good account of themselves by producing up to 10,000 pieces before being replaced. That's seven times the output obtained from the dies before changing to Bearcat.

Surprising? Not at all. Bearcat is continually chalking up new performance records in a variety of interesting applications. Bearcat is a superior, general-purpose grade of air-hardening tool steel. It has exceptional resistance to shock, and is also well suited for uses where hot-work properties and easy machining are essential. Bearcat can be used in a wide range of applications such as punches, master hobs, engraving dies, and short-run dies used in cold-forming, blanking and bending.

The best way to determine how good a job Bearcat can do is to put it to work on some difficult job in your shop. You can order Bearcat through your local Bethlehem tool-steel distributor. We also carry it in stock in our mill depot.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Retemper Tools After Grinding

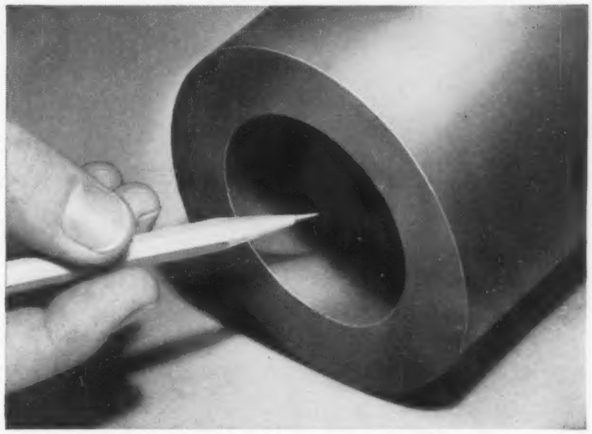
No matter how carefully performed, grinding operations on hardened tools always generate residual stresses in the tools. But as tools already contain residual stresses after they are quenched, any additional stresses are likely to cause trouble. Now, if the combined stresses are sufficiently high, cracking may occur during grinding, which makes it easy to locate the source of the trouble. But if the combined residual stresses are just below the ultimate strength of the steel, cracks will not appear for the time being. Instead, the tools are apt to crack subsequently, at the application of normal stresses set up either in handling, or in using the tools.

To avoid this difficulty, we recommend reducing the stresses to a safe level by retempering the tools immediately after grinding, using a temperature which is slightly lower than the original tempering temperature. With many toolmakers, retempering after grinding is routine procedure, a form of insurance, more or less, against running into trouble.

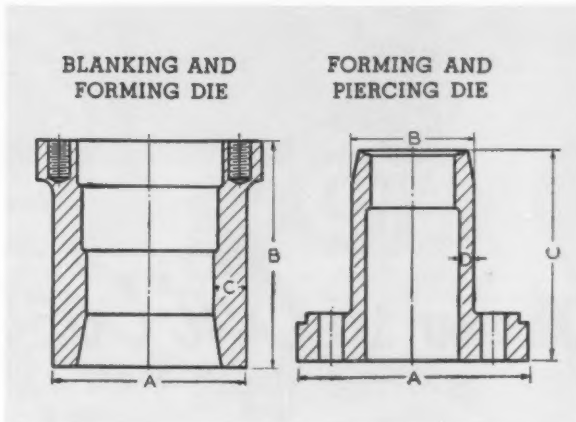
BLANKING DIE FOR HANDBAG HANDLES

This blanking die, used by Westberg Tool and Manufacturing Company, Bridgeport, Conn., for the manufacture of handbag handles, has BTR (Bethlehem Tool Room) tool steel in both the die and the punch. BTR is our long-wearing, general-purpose, manganese-chromium-tungsten grade of oil-hardening tool steel.

NO HOLE TO DRILL



you save steel, speed production when you make ring-shaped tool steel parts with Graph-Mo Hollow-Bar®



USE Graph-Mo Hollow-Bar® for ring-shaped tool steel parts and you save steel, cut scrap waste, speed production. That's because the hole's already in it. There's no need for time-consuming drilling. First step is finish boring.

Graph-Mo Hollow-Bar provides other advantages, too. It machines 30% faster than other tool steels, and has a minimum tendency to scuff or gall. The combination of free graphite and diamond-hard carbides in its structure gives exceptional wearability—three times that of average tool steels, according to users. And Graph-Mo® is the most stable tool steel made. A master plug gage made with this steel showed a dimensional change of less than 10 millionths of an inch after 12 years of use. Graph-Mo gives uniform response to heat treatment, too.

So, if you make ring-shaped tool steel parts, it will pay you to investigate how Graph-Mo Hollow-Bar can make your operation easier, faster, more profitable. Stock sizes of Graph-Mo Hollow-Bar range from 4 to 16 inches O.D. in a variety of wall thicknesses. Immediate delivery of most of these sizes may be had from warehouses of the distributors, A. Milne Co. and Peninsular Steel Co.

To learn more about this excellent tool steel, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

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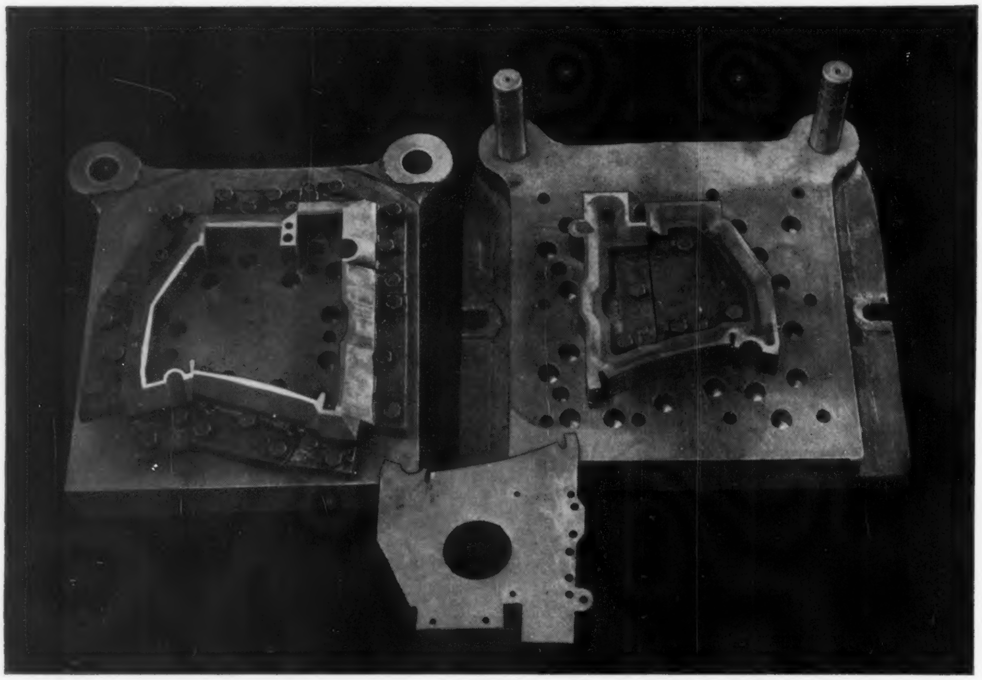

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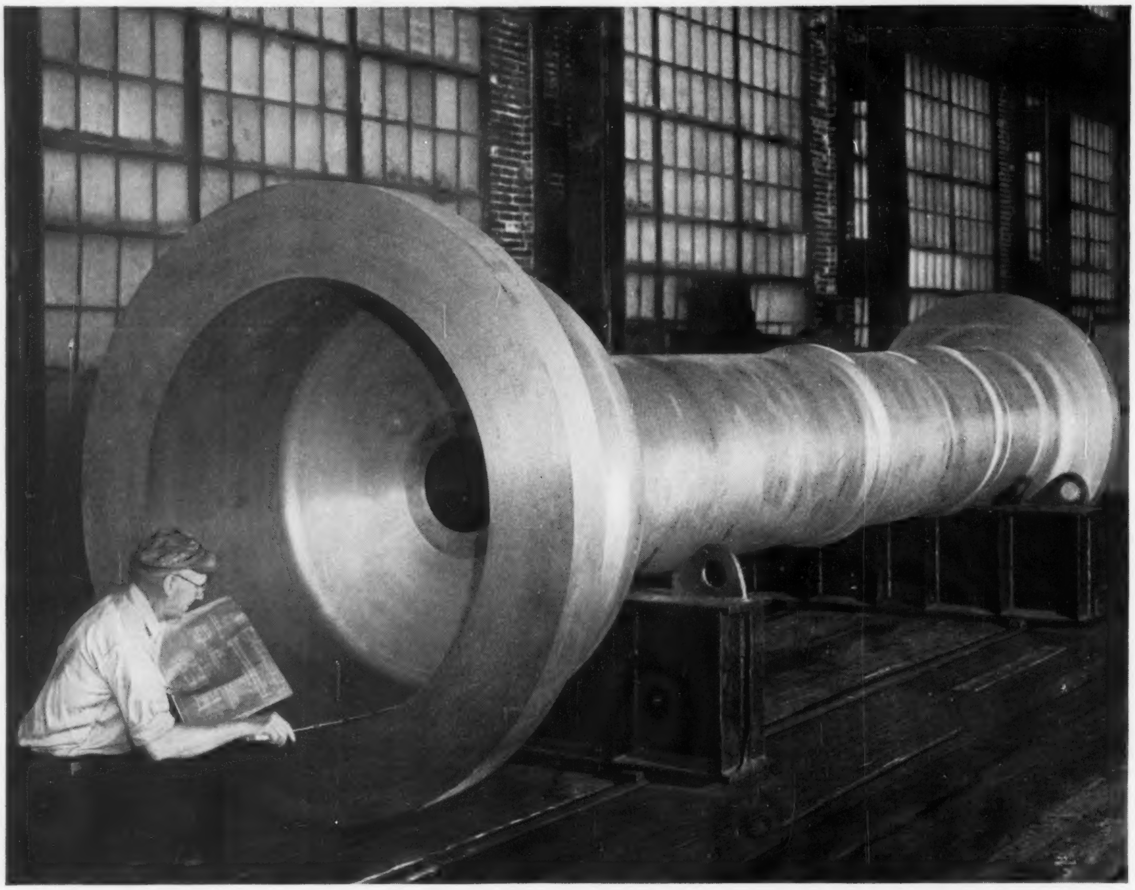

one must set the example

. . . and with high speed steel it's REX

It's a real satisfaction when you set the example by what you make . . . when it becomes a *standard for comparison.* That's why Crucible is proud to have kept REX high speed steel tops in its class for so many years.

But don't take our word for REX's superiority. Try it on your own work. Compare its structure, finish, hardenability, carbide distribution and general uniformity. You'll see for yourself why it's the *standard* wherever high speed steels are used.

Remember, REX is made only by Crucible. So call for REX at your nearby Crucible warehouse, or for quick mill delivery — *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

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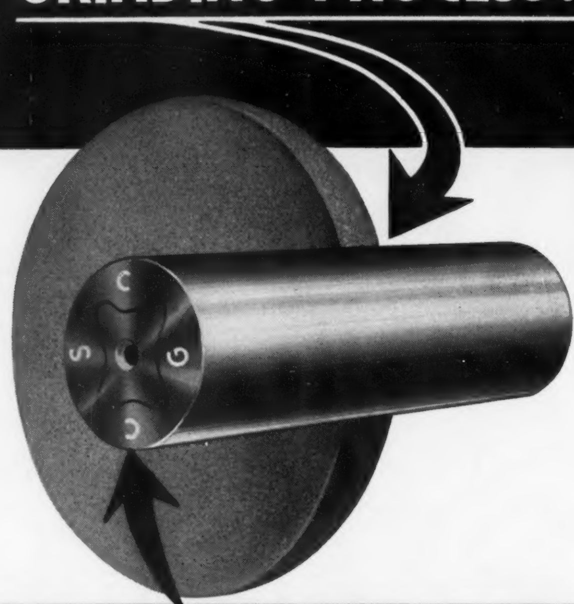
An exclusive GRINDING PROCESS...



makes

CUMBERLAND STEEL BARS

concentric, straight, smooth & *really* accurate

BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002″ on diameters 1-1/8″ to 2-7/16″ inclusive . . . plus nothing to minus .003″ on diameters 2-1/2″ to 8″ inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

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announcing A NEW NEW BRITAIN +GF+ COPYING LATHE

designed for the highest production jobs in the world

THE New Britain **+GF+** Copying Lathe was originally designed as a highly versatile quickly-tooled machine, which is available in eight different models, and is an outstanding profit maker on both short and long runs.

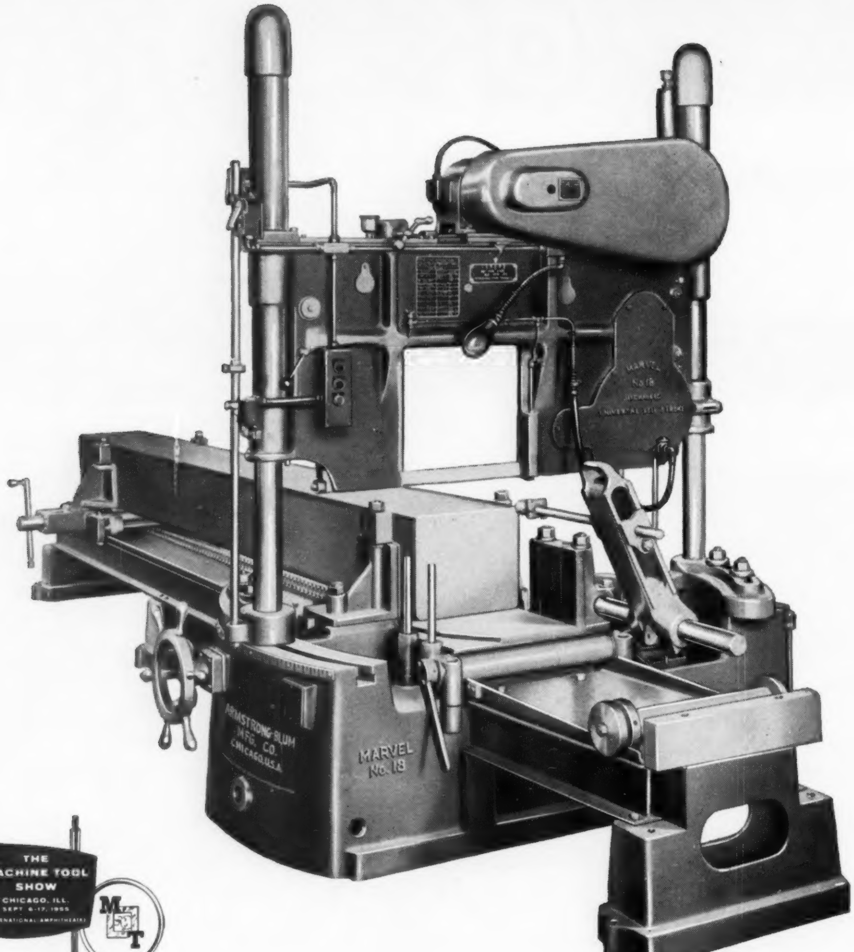
Now New Britain has added two new models, the $^{11}/_{28}$ and $^{11}/_{40}$ which successfully apply the basic principles of this new approach to copy turning, to the highest production applications in metalworking history. One of these new machines, a typical work piece and diagrams of the operations performed, are shown on the two following pages.

If you have work that requires contour turning and facing, the New Britain **+GF+** has basic profit-making advantages. You should know about them, regardless of whether your needs call for small lots, or automated long-run production.

A NEW APPROACH TO COPY TURNING is the title of a new color motion picture which is available for showing in your plant. Ask your New Britain Representative, or write The New Britain Machine Company, New Britain, Connecticut.

(See the following two pages for more details)

NB +GF+



No Job too big or too tough . . .

for MARVEL "*Giant*" Hack Saws

These giant MARVEL Hydraulic Hack Saws (No. 18, Capacity 18" x 18"; and No. 24, Capacity 24" x 24") were *basically* designed for rapid and economical cut-off of BIG WORK. They are not merely "conventional" designs "stretched" to big capacity. They are truly designed and built with the ruggedness and rigidity necessary to withstand the rough treatment of sawing big work, even though the work is in the "toughest of the tough" alloys.

They are reliably fulfilling the cut-off requirements in innumerable steel mills, forge shops, structural shops, warehouses, and machine shops, with assured low tool cost and minimum kerf loss of steel.

In addition to cutting-off, they are reducing costs by eliminating further machining operations. Heat treated die blocks are being reclaimed for re-sinking by sawing off the worn face; columns, beams, pipe, and tubing are being sawed to *finished*, square ends, eliminating milling; angular sawing is done conveniently by swinging the upper structure on the base, to any angle up to 45 degrees—*without moving the work*.

Contemplating the modern trend toward ever tougher steels and larger sizes, these are the logical sawing machines to buy, not only for today's needs but for tomorrow's as well.

Write for Catalog

MARVEL *Metal Cutting* SAWS
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

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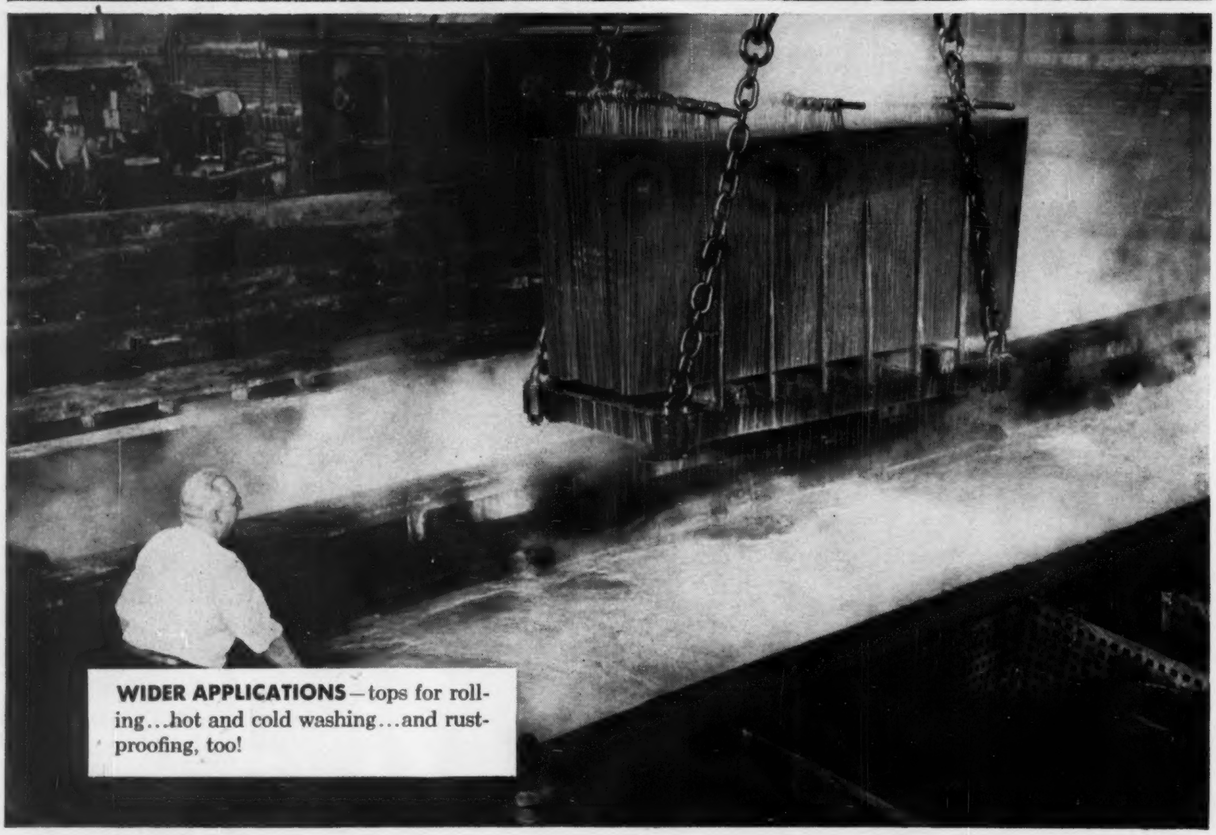
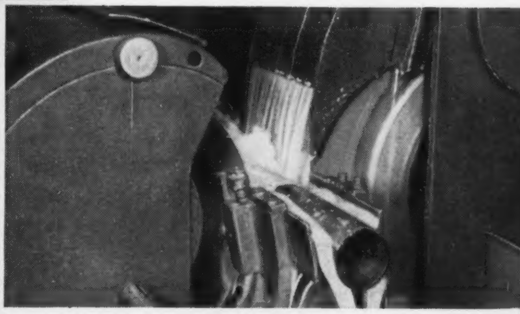
GREATER COOLING POWER—better finishes...tools last longer...production costs reduced.



WIDER APPLICATIONS—tops for rolling...hot and cold washing...and rust-proofing, too!



INCREASED DETERGENCY—prevents loading and glazing of grinding wheels, prolongs wheel life.

NEW S.E.C.O.—pours and mixes easily... has better operator acceptance... keeps parts and machines cleaner.

Industry's most widely used soluble cutting oil continues to give highest machining efficiency

OVER 100 MILLION GALLONS OF S.E.C.O. EMULSIONS USED IN '54

The reasons? Simple.
Primarily, industry has faith in Sunoco Emulsifying Cutting Oil. Its high machining efficiency has proven itself over a period of years. S.E.C.O. is the original 100% petroleum emulsifying cutting oil. 'Way back in 1916, machinists started using S.E.C.O.

Constantly improving in quality over the years, S.E.C.O. is now better than ever. During 1954 new refining facilities once more improved industry's most widely used cutting oil...gave users even higher machining efficiency ...better finishes...longer tool life... increased production.

Test the new S.E.C.O. in your own plant. Notice how its high detergency and purity keeps tools, parts and machines clean...how easily it mixes in hot, cold or hard water. Notice, too, how S.E.C.O. cuts operating costs... improves rolling operations, hot and cold washing, and rustproofing.

See for yourself why Sun's S.E.C.O. continues to be the leading emulsifying cutting oil in the country today. For information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-12.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY LTD., TORONTO AND MONTREAL

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CINCINNATI RIGID SHAPERS

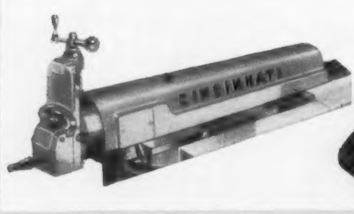
New—modern—these Rigid Shapers offer faster, more convenient controls, greater accuracy, greater dependability. The New nodular iron ram, trunnion and vise, and wide heavily ribbed column give a new rigidity—increase accuracy in cutting.

The New slot-free ram also eliminates the manual clamping of ram adjustment—a time saving feature.

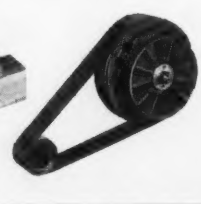
A speedy, dependable electro-magnetic brake and clutch insure a faster performance.

50 P.S.I. pressure lubrication, exclusive on Cincinnati Shapers, is a real insurance against wear and a guarantee of long trouble-free performance.

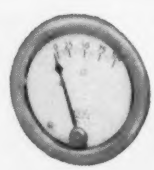
Write for the circular on the New Rigid Shapers.



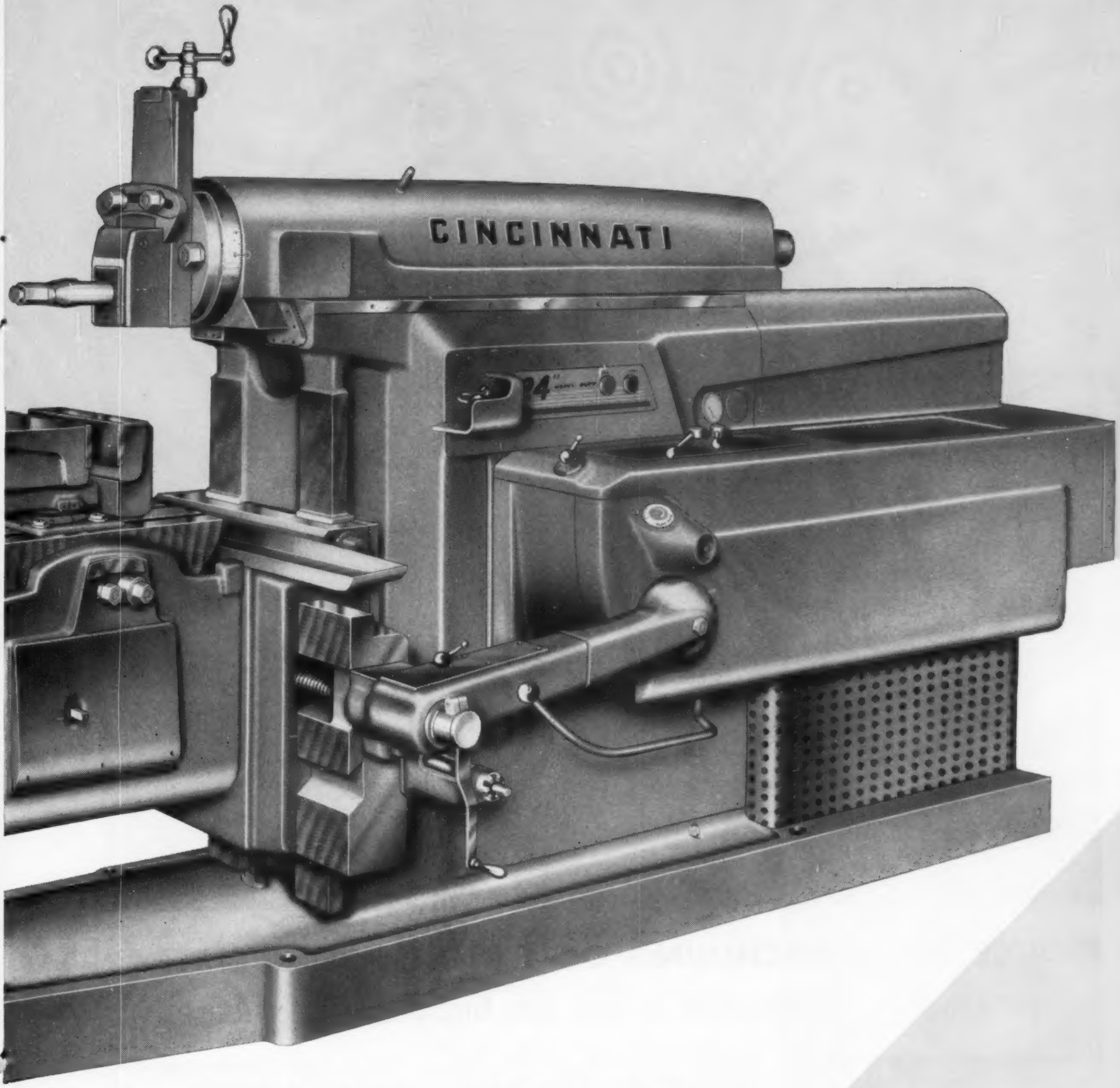
Nodular iron, slot-free ram



Electro-magnetic Clutch and Brake



The only shaper with 50 P.S.I. lubrication


CINCINNATI

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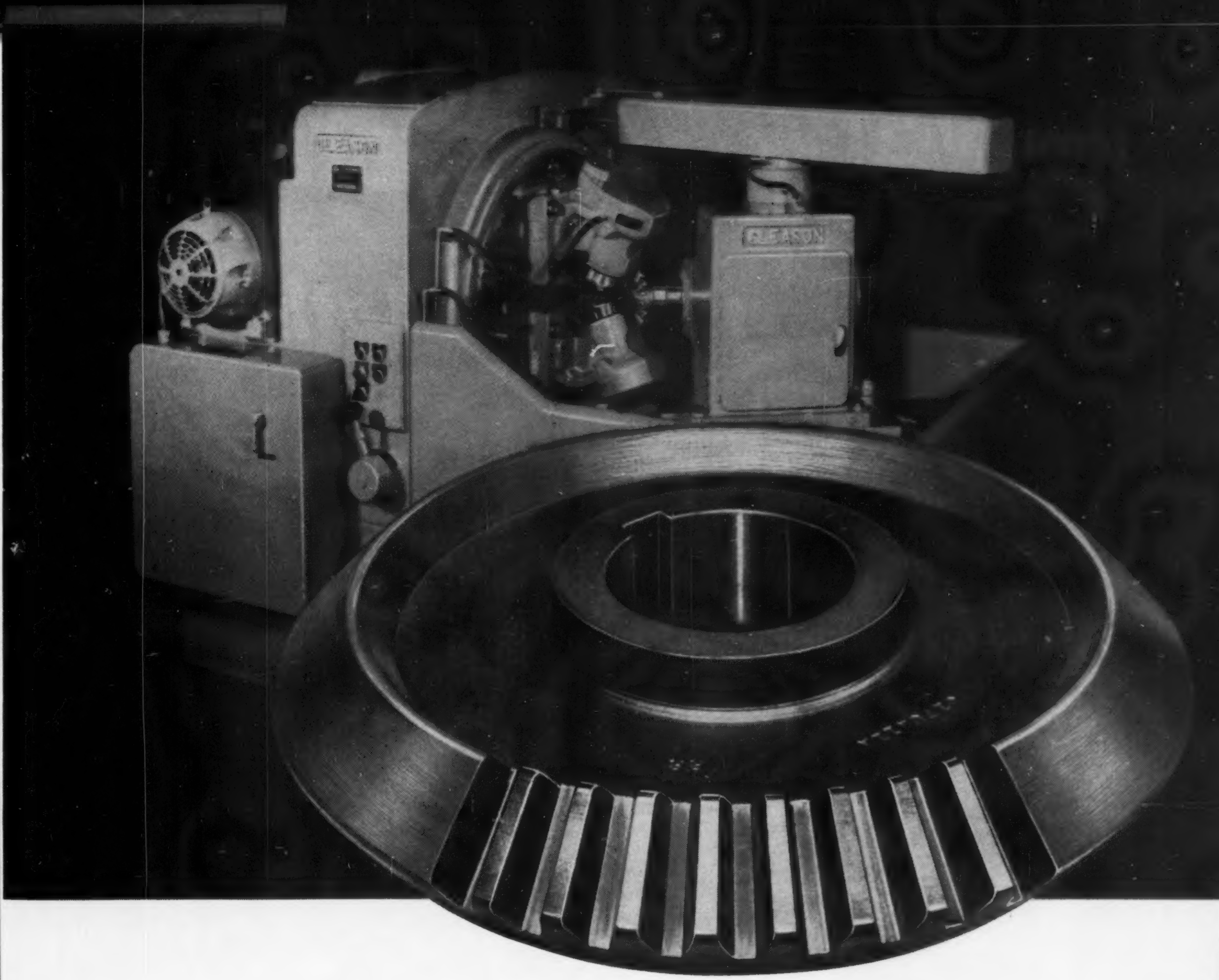
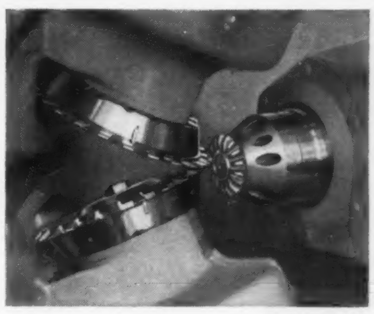
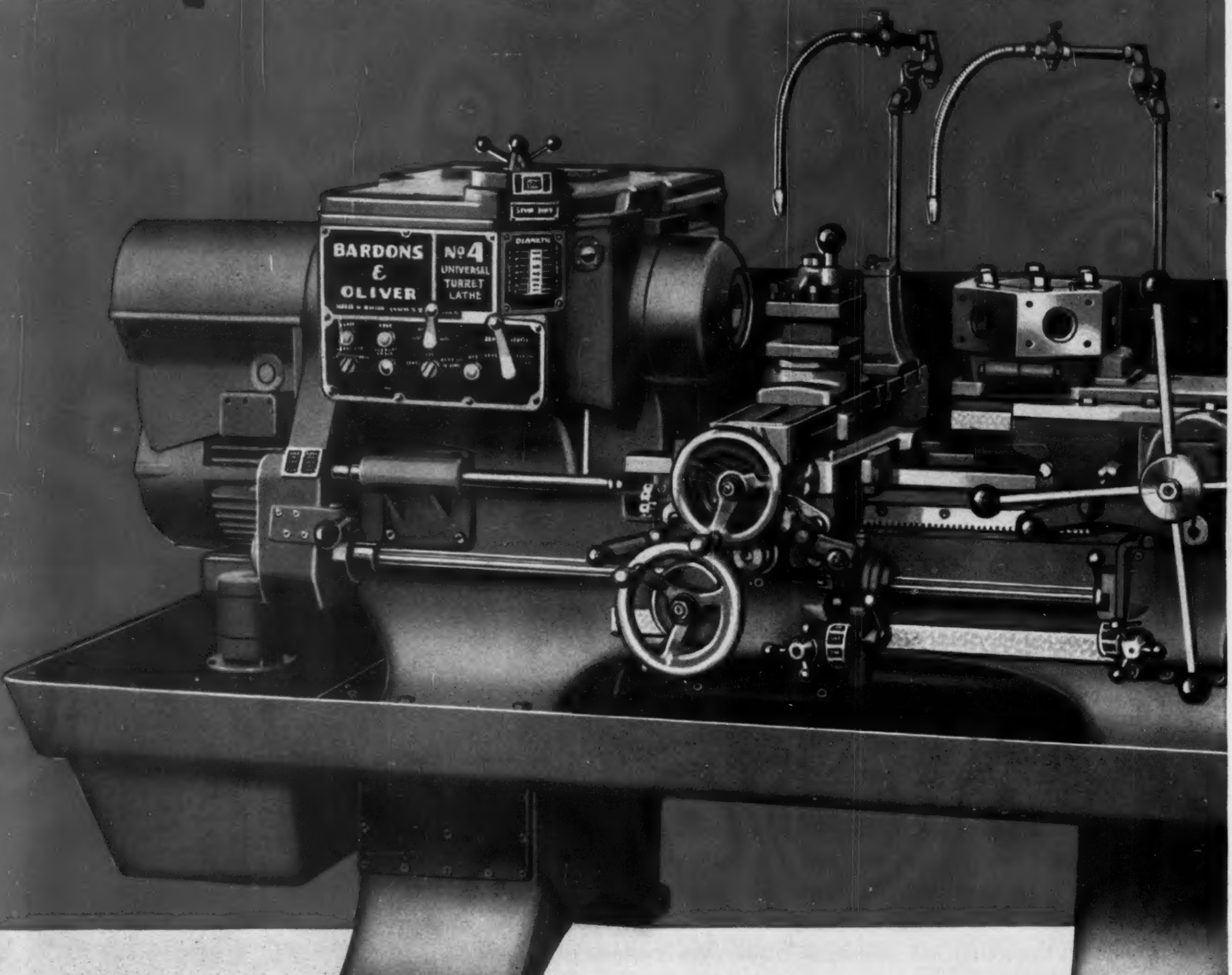

GLEASON



THE NEW BARDONS & OLIVER

No. 4 Universal Turret Lathe...



Write us on your company's letterhead for this new Catalog.

The new No. 4 Universal Turret Lathe incorporates many new features which have sharply increased its productive capacity while lessening the physical effort required of the operator.

A larger selection of spindle speeds, covers a wider overall range. Spindle speeds are instantly preselected and changed. Tool carrying stations have increased rigidity and accuracy. Controls are regrouped for handier and faster manipulation. Wider selection of feeds are provided with positive jaw feed clutches and easier engagement levers.

Power transmitting capacity is adequate to accommodate motors of ample horsepower for the latest developments in cemented carbide tooling.

We welcome the opportunity to quote production estimates on individual requirements.

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optical inspection is easy . . .
. . . even on thin plastic parts!

Bench model
Screen Size 7¾" x 5¾"

SLOTTED PLASTIC TUBES PLAY A CRITICAL PART IN THE NEW EH Exide-Ironclad BATTERY

In order to assure 100% delivery of full rated battery power, the slots in these tubes must be inspected accurately for width, flash and spacing. Quality is controlled, simply and quickly with a Jones & Lamson Optical Comparator. The operator places a tube in a V-block, compares the projection against a simple grid chart, and the whole story is told in a glance. J&L Comparators inspect in *all* planes, so he has to use only this *one* gage. And he can't get a false reading or distort the piece, because no pressure whatsoever is exerted.

***Write today** for catalog #402. You'll find that your inspection problems may be easier than you think.*

JONES & LAMSON

World's Largest Manufacturer of Optical Comparators since 1919

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A. **OPTICAL COMPARATOR DIV.**

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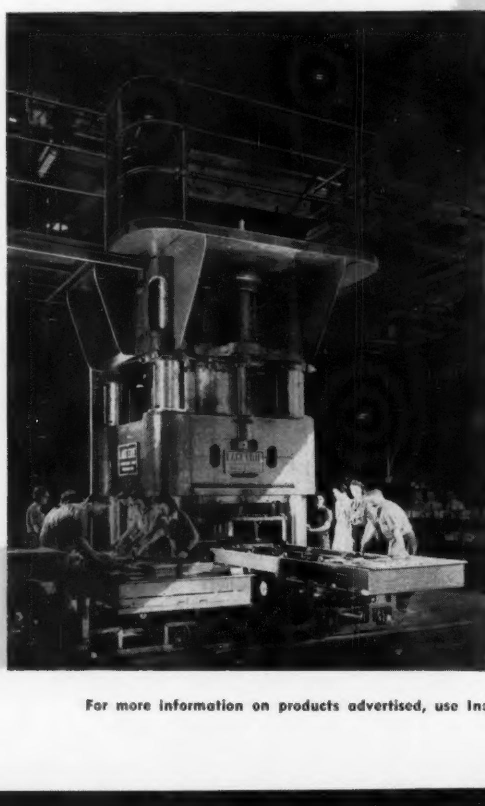
FROM BATHTUBS

TO AIRCRAFT PARTS...



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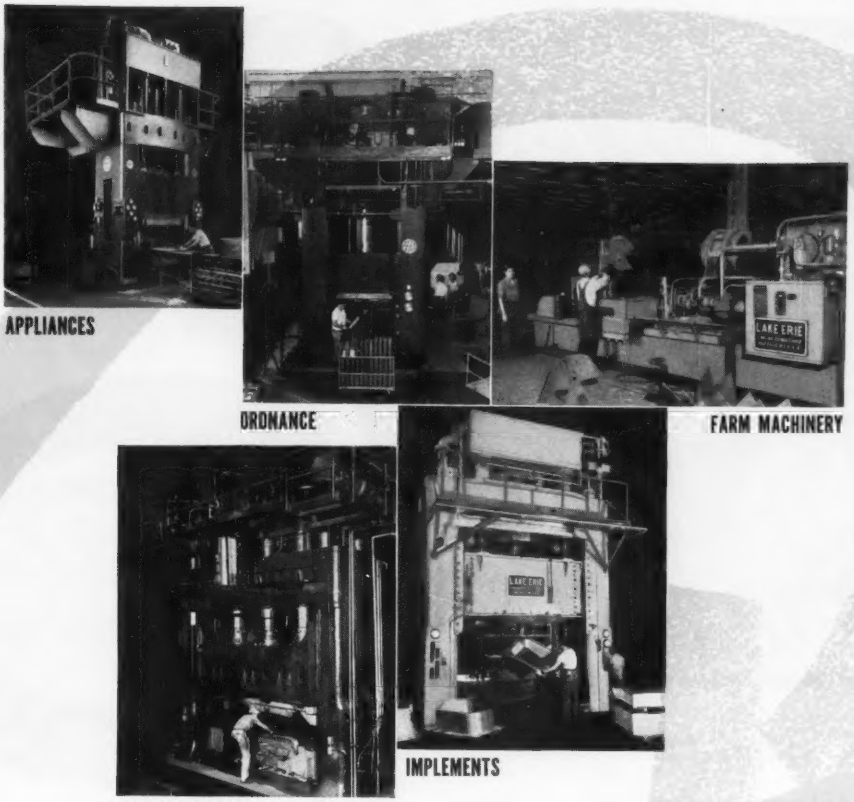


APPLIANCES

ORDNANCE

FARM MACHINERY

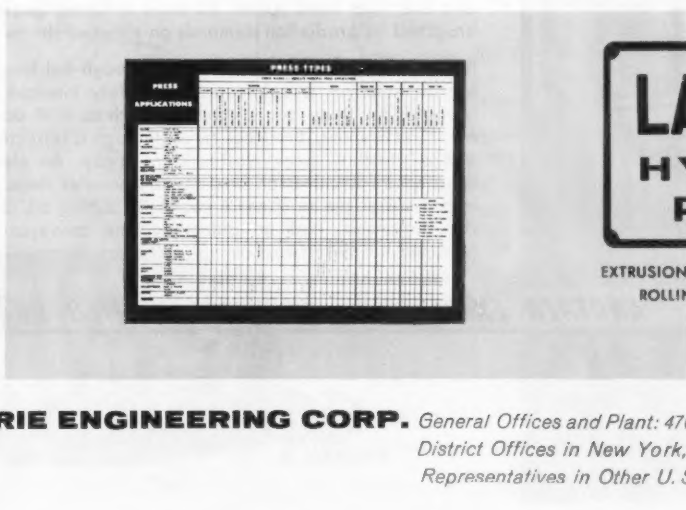
AUTOMOTIVE PARTS

IMPLEMENTS

Lake Erie Presses Make EVERYTHING

"Everything" is a broad term...but suppose you be the judge as to whether your production could be *hydraulically-pressed* to advantage. Pressing metal into a desired shape reduces or completely eliminates costly machining and scrap. For help in reaching a decision regarding this newer method of production, use our competent engineering assistance freely.

SEND FOR HANDY BUYER'S GUIDE



LAKE ERIE
HYDRAULIC PRESSES

EXTRUSION PRESSES • DIE CASTING MACHINES
ROLLING MILL AUXILIARY EQUIPMENT

LAKE ERIE ENGINEERING CORP. *General Offices and Plant: 470 Woodward Ave., Buffalo 17, N. Y*
District Offices in New York, Chicago, Detroit, Pittsburgh
Representatives in Other U. S. Cities and Foreign Countries

LAKE ERIE®

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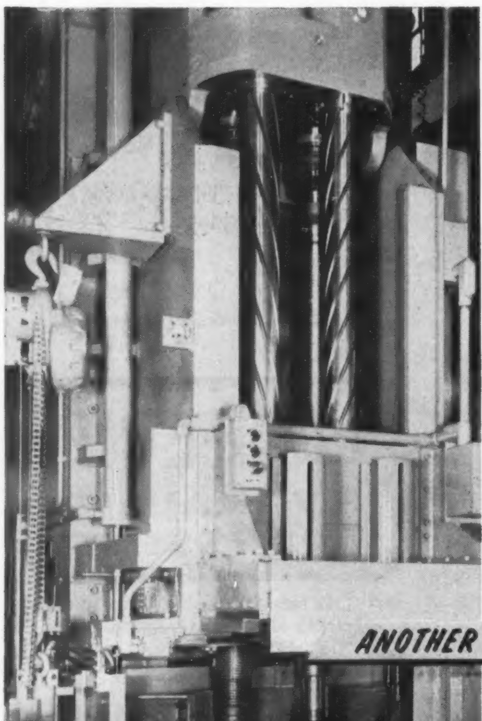
QUALITY GEARS for

QUIET TRANSMISSIONS



...broached automatically

Producing quality internal helical gear teeth is the task of two Colonial 2-station RUF-50-72 pull-up broaching machines. All gears are automatically loaded from cartridges and automatically unloaded, with the larger diameter gears being broached two at a time on each station. These quiet transmission gears with three different leads and diameters, have two left hand and one right hand spiral. All three different gears may be broached as production demands on either of the two stations.

Broaches are guided on both ends through full length of cut; broach handling is automatic with safety interlock. Colonial broaches for these gears weigh as much as 800 pounds, and are 81 inches long. Broaches return through a retractable brush and a pressure spray washes chips away. An electric hoist mounted on a universal loading arm handles these broaches in and out of the machine. A cooler for cutting oil, a magnetic chip separator, and an automatic chip conveyor are also furnished on these two Colonial pull-ups.

ANOTHER EXAMPLE OF COLONIAL UNIFIED BROACHING

COLONIAL
BROACH & MACHINE CO.
DETROIT 13, MICH.

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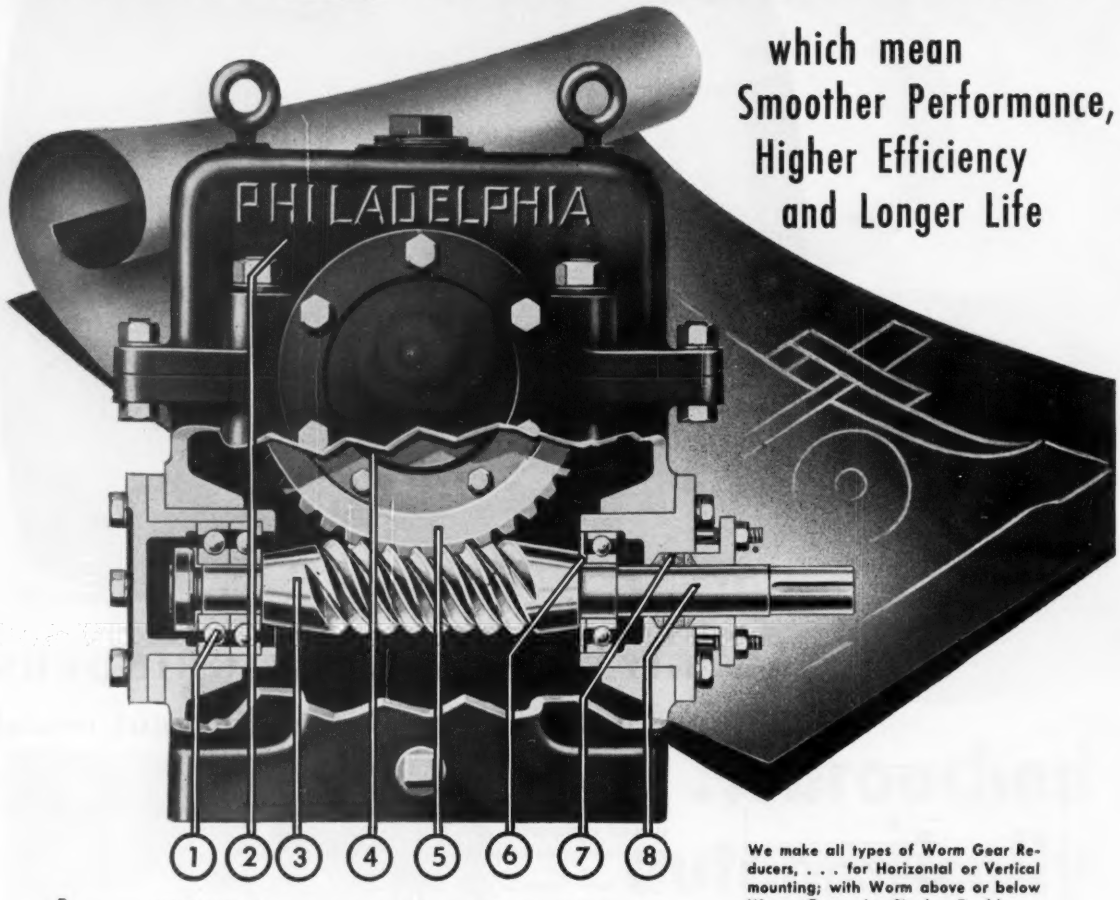
For more information on products advertised, use Inquiry Card, page 231

YOU GET ALL THESE ADVANTAGES . . .

which mean
Smoother Performance,
Higher Efficiency
and Longer Life



1____ **BEARINGS** throughout are of highest quality, calculated to take all loads and stresses in accordance with maximum ratings of units.

2____ **EXCEPTIONALLY RIGID HOUSING** of best grade cast iron . . . Strengthening ribs integral with design.

3____ **WORMS** made of SAE 3115 Steel with carburized and hardened threads. Shaft and threads smoothly ground after hardening.

4____ **GEAR SHAFT BEARINGS** run in an oil well that automatically fills with fresh oil when filled from top. Splash from the gear keeps the wells filled to the overflow point.

5____ **WORM GEAR** made from quality chill cast nickel bronze bolted to a semi-steel center. (Smaller sizes are solid bronze.)

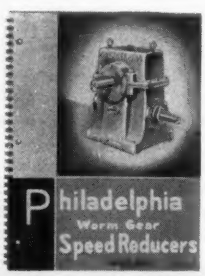
6____ **WORM AND WORM BEARINGS** run in oil bath. Baffle plates prevent flooding.

7____ **WORM SHAFT** equipped with stuffing box to prevent oil leakage.

8____ **SHAFTS** are premium quality. Always accurate, straight, concentric.

We make all types of Worm Gear Reducers, . . . for Horizontal or Vertical mounting; with Worm above or below Worm Gear; in Single, Double or Triple Reductions for medium or heavy duty service; any horsepower or reduction ratio.

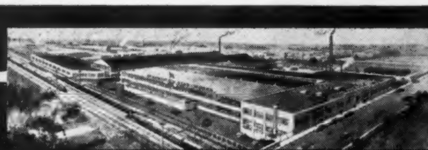
Tell us your Speed Reduction problems, and a Philadelphia Sales Engineer will gladly call upon you, . . . without obligation.



Catalog WG-51 sent upon request on your letterhead.

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
BALTIMORE • CLEVELAND
Virginia Gear & Machine Corp. • Lynchburg, Va.



Industrial Gears & Speed Reducers

LimiTorque Valve Controls

Established 1892

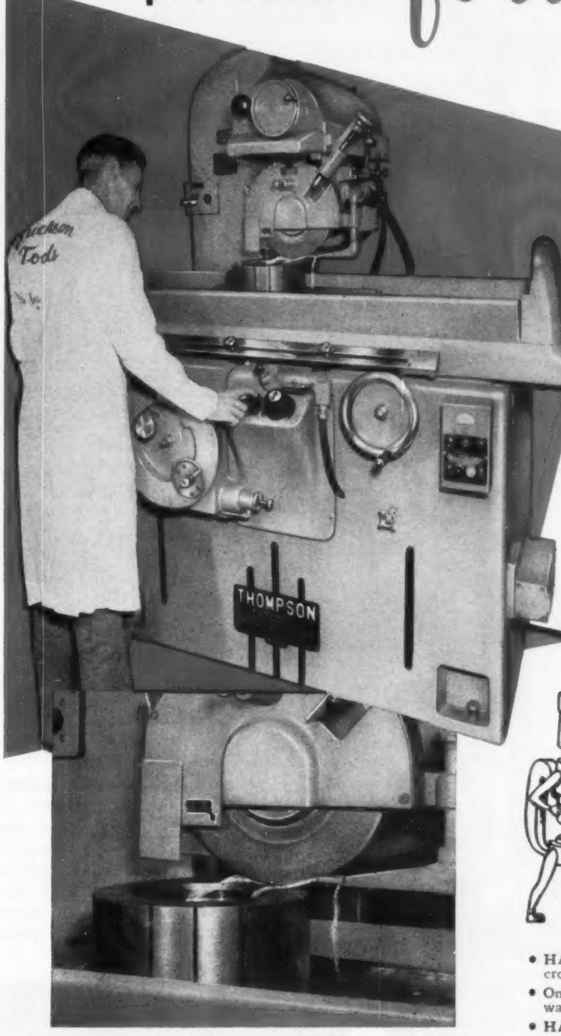
For more information on products advertised, use Inquiry Card, page 231

The Erickson Tool Company

asked for at least .0001 for parallelism and size. . .

The Thompson 2F (8x10x24) Super Precision Grinder

provided "forty millionths"



"Erickson products are sold and guaranteed to hold extreme accuracy. It is vital that we have the precision equipment necessary to manufacture these products. Our Thompson 2F Grinder delivers this precision. In the above picture we are grinding a #1200 expanding sleeve and hold within .0001 parallelism and size."

PRECISION PETE says:

"You may be surprised to find that Thompson 2F Grinders cost less than some others and still provide all these features for greater accuracy and longer service. Fast delivery, too!"

- **HARDENED AND GROUND** cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- **HARDENED AND GROUND** sealed anti-friction vertical slide.
- **HARDENED AND GROUND BED WAYS** with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.
- Handy control panel.
- Elevation micrometer stop graduated in .0001"
- **GROUND THREAD FEED SCREW.**
- Automatic wheel **TRUING** device.
- Longitudinal hand feed with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".

Call, write or wire for estimate

Thompson Grinders

THE THOMPSON GRINDER COMPANY • SPRINGFIELD, OHIO

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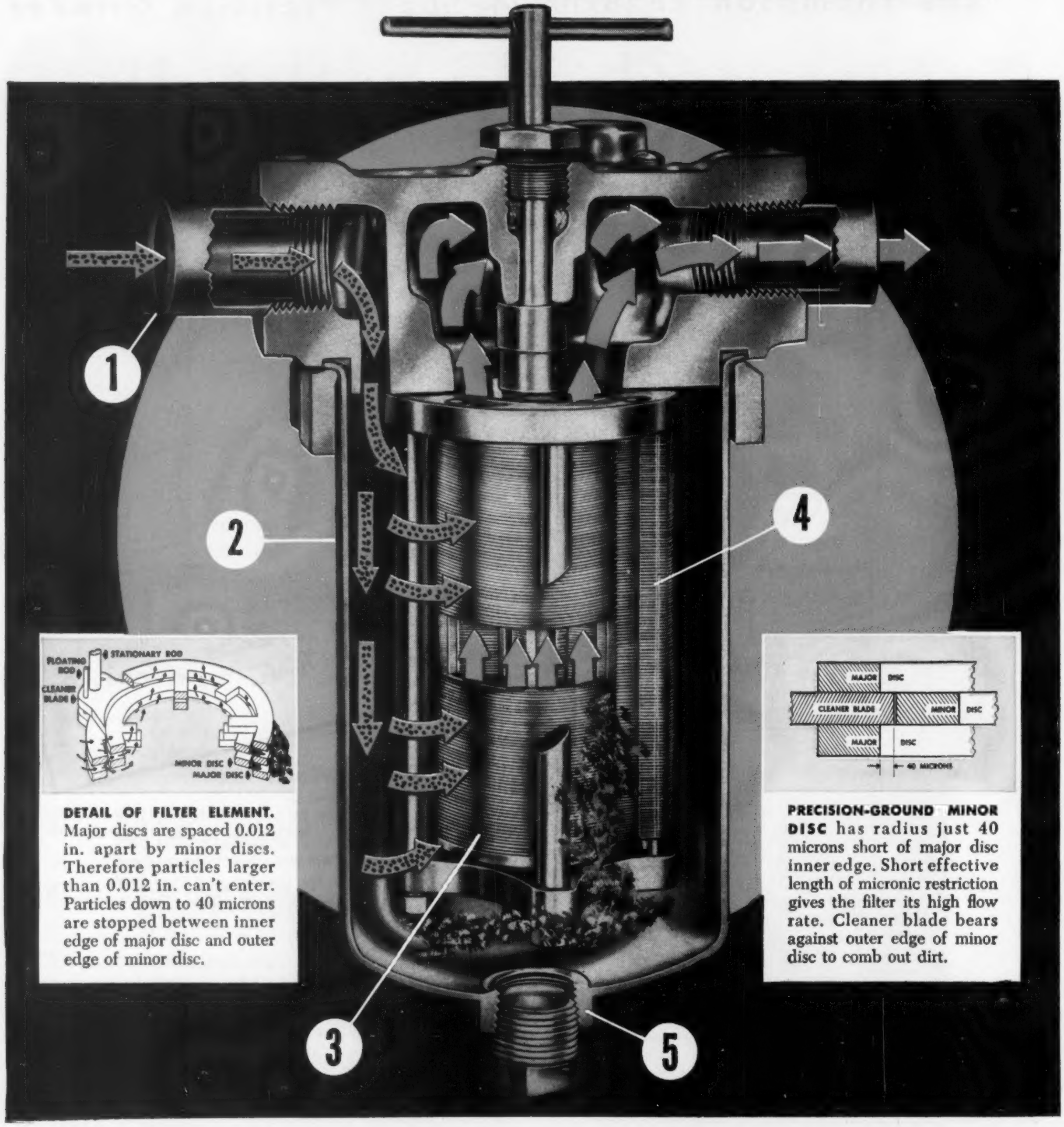
New! CUNO 40-micron



DETAIL OF FILTER ELEMENT. Major discs are spaced 0.012 in. apart by minor discs. Therefore particles larger than 0.012 in. can't enter. Particles down to 40 microns are stopped between inner edge of major disc and outer edge of minor disc.

PRECISION-GROUND MINOR DISC has radius just 40 microns short of major disc inner edge. Short effective length of micronic restriction gives the filter its high flow rate. Cleaner blade bears against outer edge of minor disc to comb out dirt.

CUTAWAY of new SUPER Auto-Klean. Dirty liquid enters inlet (1) at left, fills housing (2) and flows through metal-edge filter (3) of stacked major and minor discs. Trapped dirt is combed out by cleaner blades (4) when discs are rotated and is removed through drain (5). Clean liquid rises through center of filter element, leaves at right.

self-cleaning filter!

The SUPER Auto-Klean for lube, hydraulic fluid, coolant, fuel and other liquids

. . . and you can clean this filter by simply turning the handle!

Many times smaller than other micronic filters of equal capacity, Cuno's new SUPER Auto-Klean filter now makes possible economical, compact, micronic filtration at high flow rates and eliminates the need for replacement cartridges. On machine tools and industrial machinery, SUPER Auto-Klean gives micronic filtration of lubricating oil, hydraulic fluids, coolants, fuels and other liquids. Here's what it offers:

1. Full-flow micronic filtering with a self-cleaning filter. Filter can be cleaned continuously with motor drive or intermittently by manually turning handle.

2. Eliminates cartridge changes. Ends operating costs if you've been using cartridge filters.

3. No pressure drop build-up. An 8-in. long, 2½-in. diameter cartridge handles 30 gpm of oil of 200 SSU viscosity with only 3 psi pressure drop—up to 75% more with slightly higher pressure drop.

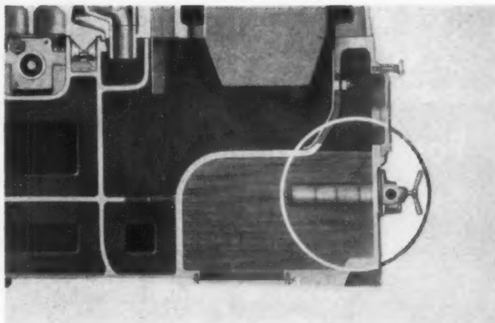
4. Positive protection against particles larger than 40 microns (actually 0.0015 in.). Filter can't rupture or channel.

5. Much smaller than replaceable-cartridge-type filters of equal capacity. It saves with lower initial costs, lower installation costs, requires less space than cartridge units. You get high capacity in a small package.

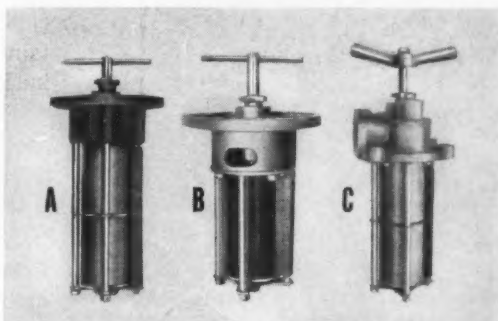
6. No duplex units needed. Handles full flow all the time with no interruptions for cleaning.

7. SUPER Auto-Klean fits existing Auto-Klean housings. You can easily replace most 2⅞-in. diameter cartridges with SUPER Auto-Klean for finer filtration.

Send coupon for complete information on the new SUPER Auto-Klean filter, for your new designs or existing equipment. Cuno Engineering Corporation, 15-12 South Vine Street, Meriden, Conn. 5.6



WILL IT FIT? Here's how one designer answered that question. Filter *(circled)* mounts horizontally in side wall of hydraulic fluid reservoir in this surface grinder.



FILTERS FOR INTERNAL PIPING *(A and B above)* allow streamlined design plus the best in filtration. Flange mounting with external outlet *(C above)* and line-type *(cutaway on facing page)* are just two of many other possibilities.

MAIL COUPON FOR COMPLETE INFORMATION

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids from More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)

CUNO ENGINEERING CORPORATION
15-12 South Vine Street
Meriden, Connecticut

Please send me full data on the NEW Cuno SUPER Auto-Klean filter.

Name____________________

Firm____________________

Position____________________

Address____________________

City__________ Zone_____ State__________

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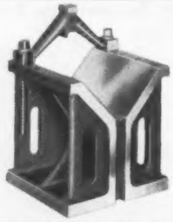
For Fast Accurate Setups

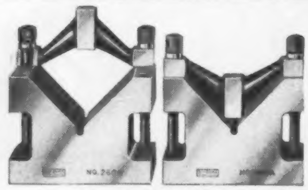
These Taft-Peirce Specialties are a 'must' for machining and inspection in the toolroom

V-BLOCKS



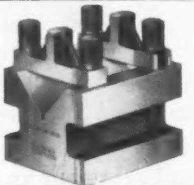
Cast Iron V-Blocks

Accurately ground to size in pairs. Made from finest quality seasoned grey iron castings. All surfaces except top are square or parallel with each other within .0005".



Steel V-Blocks

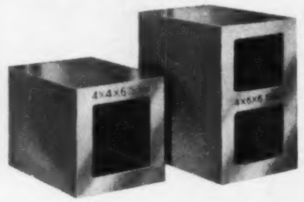
Sold in pairs only. Made of alloy steel, hardened and ground. "V" is central with sides, parallel with bottom, square with ends within .0003". All surfaces square or parallel within .0002".



Universal V-Blocks

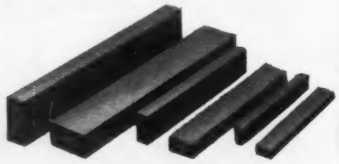
Hole in center permits quick, accurate setups. Also provides clearance for tool in drilling and boring. Made of alloy steel, hardened and ground on all working surfaces. All sides square within .0001". Sold singly or in pairs.

PARALLELS



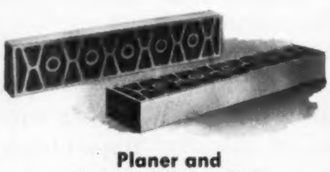
Box Parallels

Made of finest quality close grained cast iron. All sizes are parallel within .00025" in 6 inches, square within .0005" in 6 inches. Will pair up within these limits.



Steel Parallels

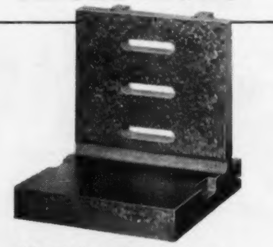
Made of alloy steel, hardened and ground on four sides. Exceptionally durable and free from seasonal changes. Not made to be used as squares.



Planer and Boring Mill Parallels

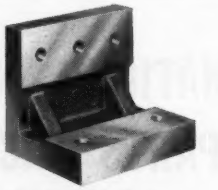
Made of finest quality cast iron. Width and thickness held within plus or minus .0005". Square within .0005" in 6 inches. Parallel within .0005" in total length.

ANGLE IRONS



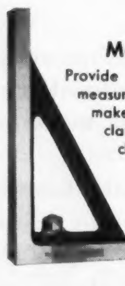
Multiplex Angle Irons

Save time by permitting a single setup of workpiece for many machining and inspection operations. All working surfaces scraped square within .0005" in 6", parallel within .0005".



Duplex Angle Irons

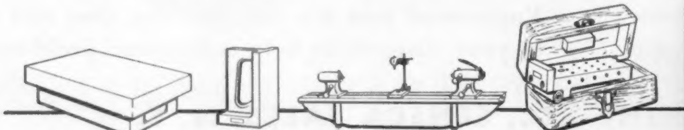
Finished inner pads increase accuracy, speed setup work and usually eliminate need for table clamping. Inner pads parallel to sides within .0005". Outer faces square within .0005" in 6".



Measuring Irons

Provide a fixed surface for measurements. Narrow width makes it convenient for clamping work on the machine table. Front face and bottom finished square within .0002" per foot.

For the complete story on these items and many more send for your copy of the Taft-Peirce Handbook.



SURFACE PLATES

'V' BLOCKS AND ANGLE IRONS

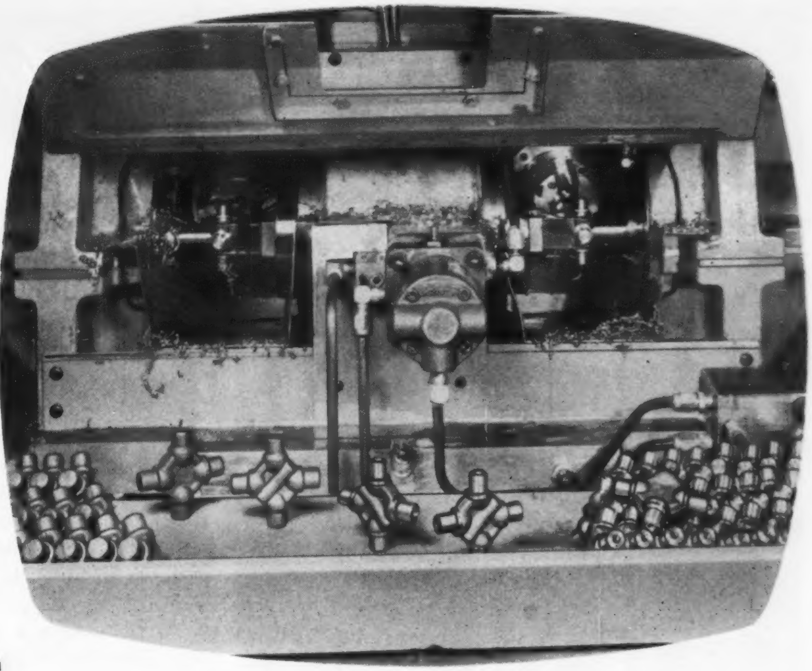
BENCH CENTERS

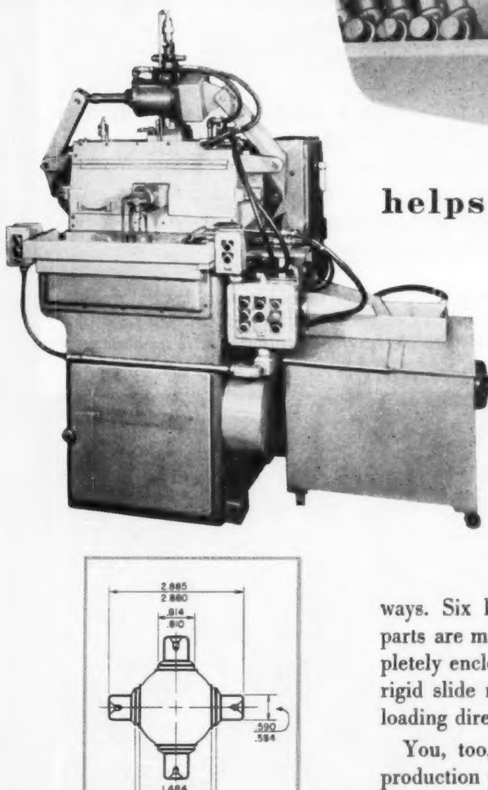
SINE BAR AND BLOCKS

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

BRYANT PRECISION BORING MACHINE





helps leading automotive parts maker meet tight production schedules

This manufacturer attains peak production per spindle investment by machining universal joint spiders on the Bryant 998 Precision Boring Machine. All four ends of each spider are turned, form turned, faced, chamfered and centered—*complete in 25 seconds!* In one pass, .088 stock is removed from diameters, .044 from the faces. *Production—144 complete parts per hour at 100%.*

In addition, flexible tooling design permits quick, simple change-over to a variety of spiders.

The Bryant 998 is mechanically operated by positive cam action. Its table moves on heavily pre-loaded, anti-friction ball slide ways. Six hundred $\frac{3}{8}$"-diameter pre-loaded balls carry the table. All running parts are made of hardened and ground steel, permanently lubricated and completely enclosed. The large diameter bars and 6" table motion provide accurate, rigid slide mounting which holds the table to a true path regardless of load or loading direction.

You, too, can get uniform fine finishes, high repetitive accuracy and peak production per spindle investment—in precision boring, drilling, turning, facing, grooving, and contour boring and turning. ***Write for Bryant 998 Job Folder.***

Bryant offers you three methods of acquisition: 1.) outright purchase, 2.) conditional sale (short-term or long-term), 3.) lease.

BRYANT chucking grinder co.

20 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Groove Gages • Granite Surface Plates • Spindles • Magnetic drums for computers

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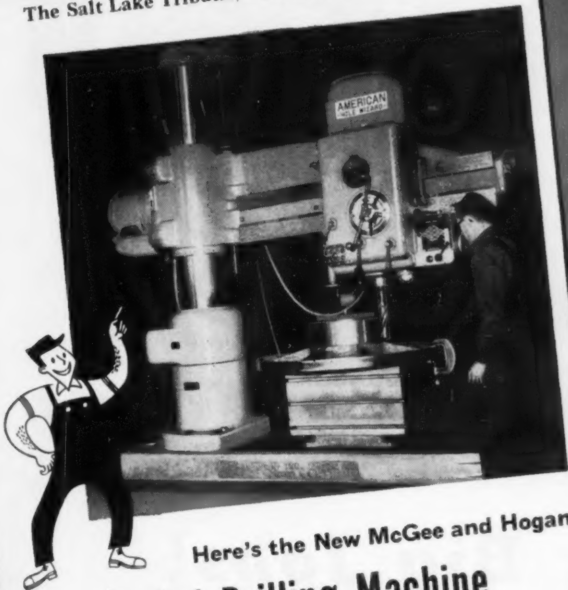
praise from Caesar...

The Salt Lake Tribune, Sunday, June 20, 1954



Here's the New McGee and Hogan

Radial Drilling Machine

With its 5-foot arm, this modern machine is capable of driving a 3″ diameter drill to capacity through the center of a 10-foot diameter solid steel work piece. Also used for tapping and large boring operations, it is the only really modern radial of such dimensions in any intermountain machine shop doing repair work.

Veteran operator Pat Langford, above, finds the centralizing of all controls on this machine a big advantage over old-fashioned, scattered control points. Time saved means lower costs per job.

McGEE & HOGAN
MACHINE WORKS
1154 South 2nd West · Salt Lake City · 84-5291

When a customer of such outstanding caliber and recognized reputation as the McGee & Hogan Machine Works of Salt Lake City, Utah spends his own good money to tell the world how good his new "AMERICAN" Hole Wizard Radial is that's really "Praise from Caesar."

The accompanying McGee & Hogan advertisement appeared in the Sunday, June 20th, edition of The Salt Lake Tribune. It shows the new 5′ 13″ "AMERICAN" Hole Wizard Radial at work in their plant producing work for customers at **"lower costs per job."**

Lots of power, wide range, convenient controls and plenty of ruggedness are doing for McGee & Hogan Machine Works exactly what "AMERICAN" Hole Wizard Radials will do for you.

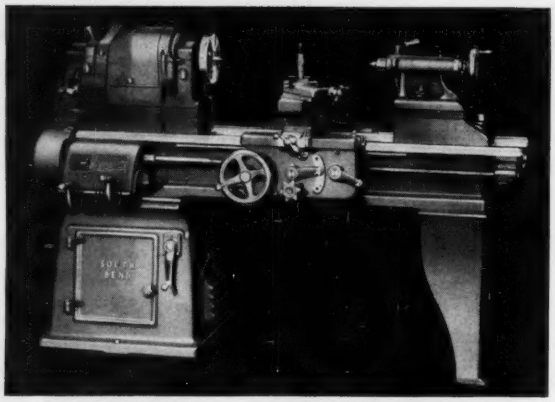
And Mr. Ray Hogan adds another punch to this testimonial by telling us in a recent letter, "Your machines are doing a wonderful job for us."

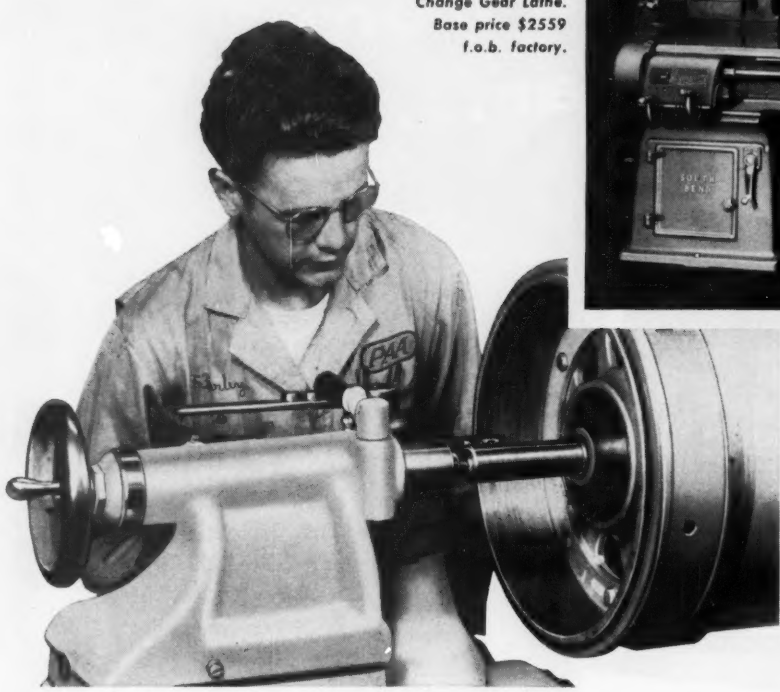
Send for bulletin No. 327 and get the facts.

THE AMERICAN TOOL WORKS CO. Cincinnati, Ohio U.S.A.

Lathes and Radial Drills

16-24" x 6' Quick Change Gear Lathe. Base price $2559 f.o.b. factory.





SOUTH BEND 16-24" LATHE

CAPACITY for Big Jobs! ACCURACY for Any Job!

Here's a lathe with a versatility that makes equipment dollars go further. Its 24" swing provides the capacity for handling a variety of large diameter, medium-weight jobs whose size would otherwise require large, heavy lathes. This extra capacity is achieved without any sacrifice of efficiency in the machining of smaller work.

Having an unusually wide range of spindle speeds, all sizes of work can be machined at effective cutting speeds. The improved South Bend two lever gear box permits instantaneous selection of power feeds for any turning, facing, or thread cutting operation. A complete line of chucks, tools and attachments simplifies tooling the lathe.

SPECIFICATIONS: Swing over bed and saddle wings—24⅜". **Collet Capacity**—1". **Spindle Speeds,** sixteen—11 to 710 r.p.m. **Longitudinal Feeds**—48 R.H. or L.H., .0015" to .0841". **Cross Feeds**—48 in or out, .0006" to .0312". **Thread Cutting**—48 Threads R.H. or L.H., 4 to 224 per inch.

Compared with our costs
OUR PRICES ARE LOWER
than they were back in 1941

Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

PLEASE SEND INFORMATION CHECKED:

☐ 9" and 10" BENCH LATHES ☐ 10" to 16-24" FLOOR LATHES ☐ DRILL PRESSES ☐ ½" & 1" Collet TURRET LATHES ☐ TOOL GRINDERS ☐ 7" BENCH SHAPERS

Name________________ Street________________

City________________ State________________

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

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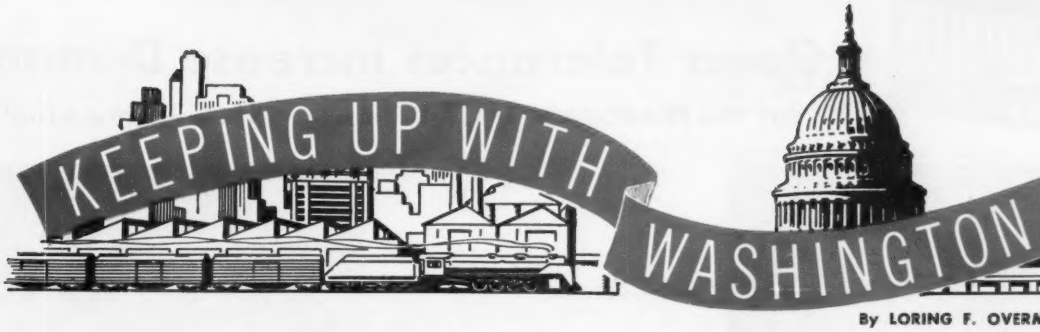

By LORING F. OVERMAN

Operation Stratosphere for Business

THREE topics of major interest to the machinery industries—economic outlook, automation, and the role of machine tools in mobilization planning—have been the subjects of recent Washington conversations.

The most recent conclusion of the Congressional Joint Committee on the Economic Report is that capital goods industries are poised for a ten-year flight into a business stratosphere. Economists attached to the Joint Committee estimate that our gross national product—all the goods and services produced in one year—will rise 50 per cent in the next ten years.

Today's gross national product has a value of $392,000,000,000; by 1965 it is expected to expand to more than $535,000,000,000. Some estimate that it will reach $565,000,000,000 by the year mentioned if the annual per-man-hour output increases 3 per cent instead of the estimated 2 1/2 per cent due to improved machinery and processes.

The expected greater volume of production and the increasing cost of labor and materials will require, as an offset, the use of machines that will increase workers' efficiency. What this means to the machinery industries is evident in a projection of present per-man investments in plant and equipment. The average plant - machinery - tools investment per man in 1939 was $6000; in 1954, $13,500. If per-man investments continue at the 1945-54 rate, the investment could average $23,500 by 1965.

In the nine years that have passed since World War II, American business has invested $300,000,000,000 for capital goods, an average of $33,000,000,000 a year. In the next five years, annual expenditures for capital goods are expected to average $40,000,000,000. If an annual rate of $60,000,000,000 is reached by 1965, economists expect about $25,000,000,000 will be expended to replace obsolete equipment, and that $35,000,000,000 will be applied to expansion of capacity and to accelerated and adequate replacement of existing equipment.

Congress Eyes Automation

How much of industry's production increase can be accomplished through automation, and what the results of such a procedure might be, have been subjects before a full-fledged Congressional Committee investigation. Industry, labor, and theorists presented their views before a subcommittee of the Joint (Senate and House) Economic Committee. Representative Wright Patman, committee chairman, said that the subcommittee selected the metal-working, data-processing, chemical, electronics, transportation, and communications industries as illustrative of the kinds of problems which may be faced in the trend toward automation.

Both labor and theory—represented respectively by C.I.O. president Walter Reuther and Professor Walter S. Buckingham, Jr., of the Georgia Institute of Technology—warned that "A high degree of public responsibility from leaders of industry, labor, and Government will be required if the mistakes of the first Industrial Revolution are to be avoided."

Industry's position, as voiced by D. J. Davis, Ford vice-president for manufacturing, was that any labor displaced by automation will be more than absorbed by other openings created in the process. He pointed out that growth of the automobile industry in the past has been responsible for 90 per cent of the employment in the gasoline industry, 80 per cent in the rubber industry, 70 per cent in the plate glass industry, and 60 per cent in alloy steel.

Mr. Davis said that automation could be employed only in large-volume operations. Under ideal conditions, the advantages could be fivefold—increased production, lower accident rate, lower direct-labor costs, improved quality, and reduced floor space requirements.

Walter Reuther, in pointing out that labor does not oppose automation if it is properly evaluated, urged the establishment of a central "clearing house" to make a continuing study of the subject. Particularly, he said, the study should cover the steps needed to make certain that purchasing power is maintained during the transition from the direct-labor system to one involving automation.

Phantom Machine Tool Orders

Washington is still hoping to avoid, in case of another war, the machine tool shortages which handicapped early production of military equipment during past emergencies. So the Business and Defense Service Administration and the Office of Defense Mobilization are again working on the idea of phantom contracts which would become operative automatically in the event of war. Details of such a plan already have been discussed with the Metalworking Equipment Industry Advisory Committee.

There seems little likelihood that the phantom order plan will materialize quickly. One stumbling block is lack of authority to obligate the Government for expenditures on a "when, if, and as," basis. Although the Office of Defense Mobilization may now have the authority to proceed with some types of phantom contracts, the Defense Production Act is to expire on June 30, 1956. This expiration date may in itself provide Congress with sufficient reason to enact legislation providing for conditional authority to complete contracts of the type planned for the machine tool industry.

To help work out the details, BSDA has announced that a three-man task committee from industry will work with BSDA and the ODM. The target date for agreement is the end of this fiscal year, when BSDA hopes to be able to sign contracts with machine tool builders. The proposed contracts do not contemplate actual purchase of machine tools. Instead they represent an indemnity against losses which are inevitably being incurred in rapidly accelerating production prior to the placement of firm contracts.

Component Studies Due

Studies of valves, bearings, and fractional horsepower motors—part of a long-range survey of fifty-seven subjects—were nearing completion in late October, the Office of Defense Mobilization announced. The studies are being made to spotlight shortages in capacity needed to produce military components. In one of half a dozen studies recently completed, ODM authorized the purchase of machine tools to round out capacity needed for the mobilization requirements for turbines and reduction gears. Currently, ODM is investigating reported shortages of valves, fittings, and anti-friction bearings.

Net Profits—Before or After Taxes?

THE most prosperous business year in the history of our country nears its conclusion and corporations will soon issue glowing statements about their earnings. They can be rightfully proud of their accomplishments. However, their statements will generally be misleading in one respect and can be harmful to the interests of the individual concerns and the business world at large.

Financial statements all cite net profits. According to Webster's dictionary, the word "net" means "remaining after deduction of all charges, outlay, loss, etc." Persons unfamiliar with the terminology of the accounting profession usually assume that net profits constitute the amount of money that a corporation has at its disposal for distribution in the form of dividends to stockholders, for increasing production facilities, or for a variety of other purposes.

This conception is entirely erroneous because net profits are merely the profits before income taxes are deducted. In most cases actual profits are less than 50 per cent of the net profits. The General Motors Corporation will, for example, show almost unbelievable net profits of about one billion dollars—the greatest of all time for any one corporation. The actual profits, however, will probably be less than half that amount. It is unfortunate that the financial statements of business concerns do not make this point clear because it gives certain interests the opportunity of developing propaganda antagonistic to business and to our free enterprise system.

Soon after the first of the year, publications issued by labor unions to their rank-and-file membership will also cite the huge profits of "greedy big business" with glaring headlines and place honest companies in an unfavorable light. No mention will be made of the fact that these profits were *before taxes*. Labor leaders know this fact but not the rank-and-file membership. No wonder union members generally feel that even their most insatiable demands are reasonable.

The fault for misconceptions about business profits must be laid to business companies themselves. In their desire to prove periods of successful operation, they issue the highest possible figures. To avoid any misunderstandings, it would appear desirable that the phrase "before taxes" should always appear in parentheses after "net profits."

Charles O. Herb

EDITOR

A NEWS REPORT

. . . from the home of FASTEST machining steels

Leaded plates—Now lead has been added to E-Z-Cut plate. As a result, E-Z-Cut, which was already considered one of the best free-machining plates on the market, is better than ever. Tests show that New E-Z-Cut cuts even faster, polishes to a better finish than non-leaded E-Z-Cut. And because sulphur content is much lower, is much cleaner steel. First stocks include thickness up through 3".

Did you know that the largest stocks of Ledloy—world's fastest machining steel, await your call at Ryerson? Our stocks are largest from both a tonnage and size range standpoint. And stocks of other C.F. bars are also in excellent shape.

New sizes of leaded alloys—Increasing demand for New Rycut 50, fastest machining .50 carbon alloy steel has prompted Ryerson to increase the range of sizes in stock. Hot rolled rounds, both annealed and heat treated, are now available in large sizes—up through 9½". So shafting, gears, cams, etc. can be produced at savings possible only with Rycut alloys.

"Increased production 200% using new Rycut leaded alloy"—"cut unit costs 32% using Ryerson Ledloy"—"reduced machining time 35% with New E-Z-Cut plates." Hundreds of reports like these testify to the savings realized with Ryerson faster cutting steels in shops from coast to coast. And Ryerson engineers will be glad to help you apply these steels to your operations.

You can be sure of getting the latest and best of proved fast-machining steels at Ryerson because, serving the widest market with the largest, most diversified stocks, we are in close touch with every new development.

So if you want to save on the final cost of a machined part—whether carbon, alloy or stainless steel—call the home of fast-machining steels—call Ryerson.

REDUCE COSTS WITH:

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Free-Cutting Stainless	**Ledloy Bars**
Medium Carbon Rytense A. A.	**Case Hardening Rycase**

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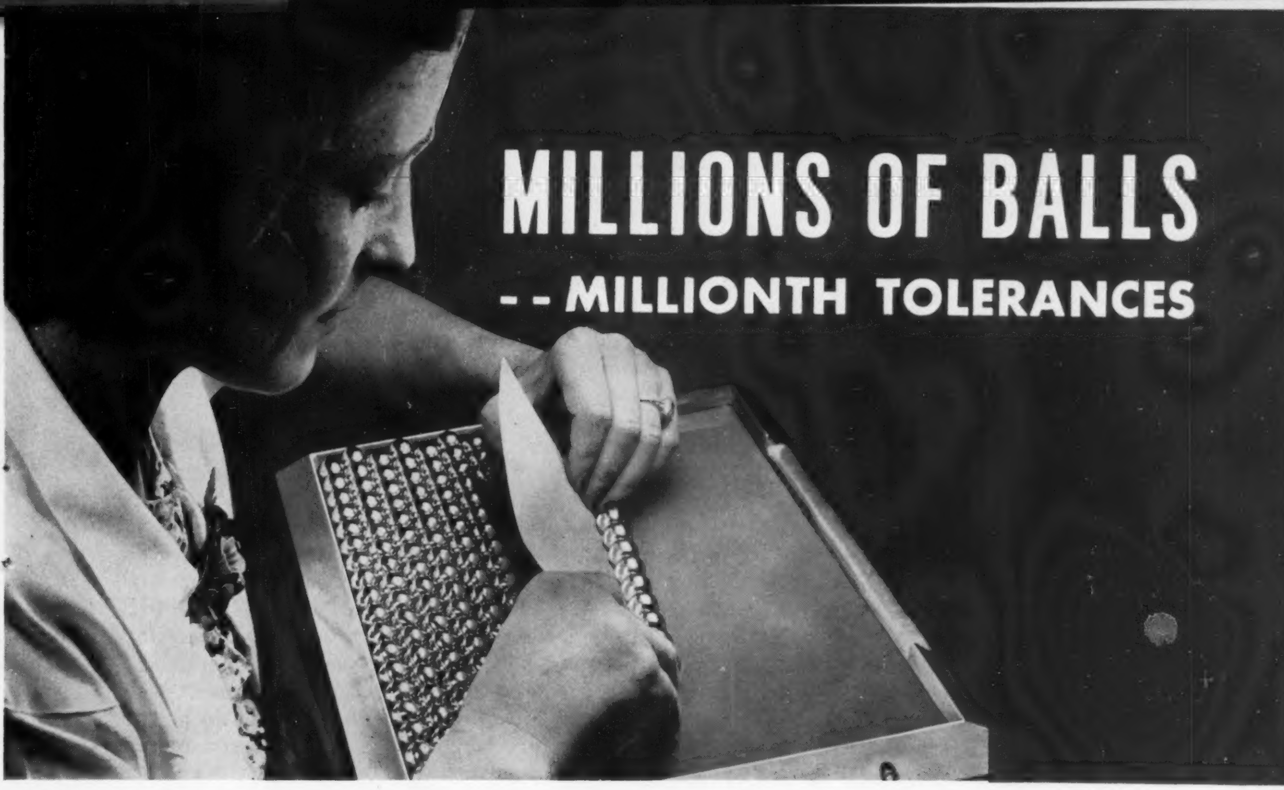


MILLIONS OF BALLS
--MILLIONTH TOLERANCES

More than 5,500,000 high-carbon chromium-steel and stainless-steel balls, varying from 0.025 to 1 7/8 inches in diameter, are produced per day in New Departure's Ball Plant at Bristol, Conn. Tolerances for sphericity and size variation are maintained as low as 0.000005 inch for balls to be employed in instrument bearings

By EDWIN H. GOODRIDGE, Jr.
New Departure Division
General Motors Corporation
Bristol, Conn.

WHILE most balls manufactured today are used in bearings, there are ever-increasing demands for this precision product in a wide variety of applications. For example, some of the more popular uses include master balls for tool-room and production gaging and balls for check-valves, lubricators, and supporting slides, as well as other reciprocating machine members. Also, steel balls are employed in many clutches, ratchets, extractor tools, and feeding devices.

New applications which have greatly boosted ball requirements are power steering units for automobiles and trucks, air conditioning valves (which employ nylon balls), and ball-point pens and pencils. Three different sizes of tiny steel balls are currently being used for pens and pencils. They are 1 millimeter, 1/32 inch, and 0.025 inch in diameter, and are all held within 0.000010 inch for out-of-roundness. It requires 436,539 of the smallest balls (0.025 inch in diameter) to weigh 1 pound.

To meet the booming demand for balls of various sizes and specifications, New Departure maintains two ball manufacturing plants. One, in Sandusky, Ohio, converts approximately 18,000 pounds of coiled wire per day into 12,500 pounds of finished balls. This production, based on a two-shift day, represents about 1,200,000 precision balls, ranging in diameter from 7/32 to 17/32 inch.

The second New Departure plant, at Bristol, Conn., is believed to be the world's largest facility for producing high-carbon chromium-steel and stainless-steel balls. Here, about 30,000 pounds of coiled wire and bar stock per day are

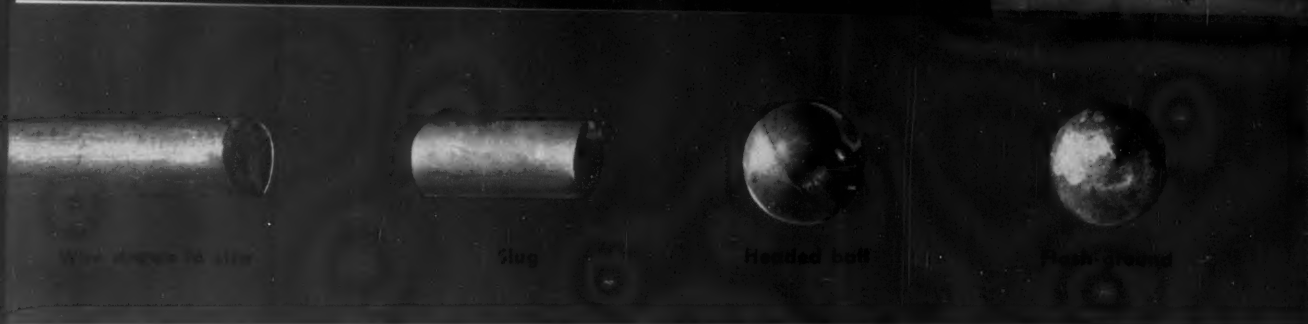


Fig. 1. Successive stages in steel ball manufacture—from

transformed into 24,000 pounds of finished balls. This represents approximately 5,500,000 balls varying from 0.025 to 1 7/8 inches in diameter. Successive steps in the production of balls are illustrated in Fig. 1. Some of the interesting operations performed and specialized equipment employed at the Bristol manufacturing plant will be described in this article.

Electric furnace, A.I.S.I. Type 52100 steel, hot-rolled into coils of wire having an average weight of about 300 pounds, is employed for the production of balls up to and including 1 1/16-inch diameter sizes. Larger balls are made from bar stock which is purchased centerless-ground, ready for hot-heading. This steel contains from 0.95 to 1.10 per cent carbon, 0.25 to 0.45 manganese, 1.30 to 1.60 chromium, 0.20 to 0.35 silicon, and a maximum of 0.025 per cent each of sulphur and phosphorus. Samples from both ends of each coil and bar are carefully inspected in the laboratory. If seams or other structural imperfections are detected, the material is rejected.

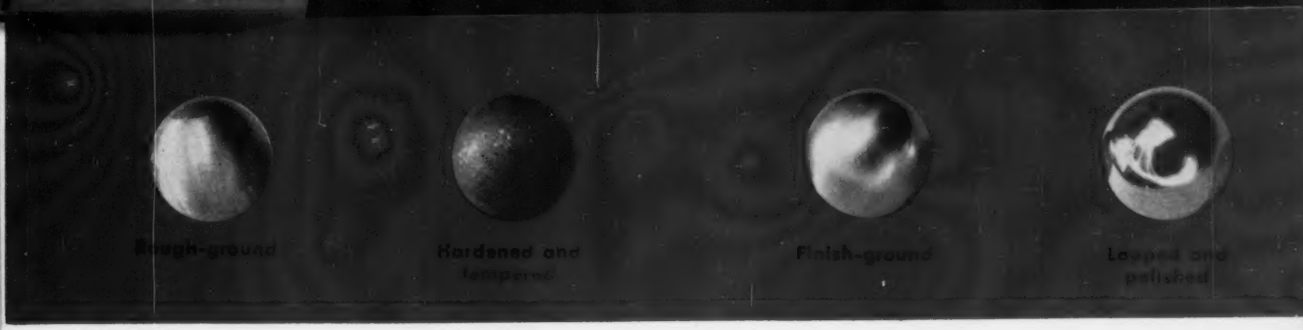
Prior to forming the coil stock, it is necessary to anneal the wire in order to soften the material and make it more ductile. The coils of wire are loaded on a mandrel and lowered into a vertical, gas-fired annealing furnace, Fig. 2. For wire used to make balls 3/8 inch in diameter, the furnace is heated to 1300 degrees F., coils are introduced and the temperature is raised to 1380 degrees F., and then the coils are held at this temperature for six hours. At the end of this heating cycle, the wire is cooled to 900 degrees F. while still in the furnace, and is then removed and allowed to cool to room temperature.

To free the wire from scale formed on its surface by the annealing operation, it is bent by being passed through a series of rolls. In this way, scale is snapped from the wire. Any remaining scale is removed by pickling in a water solution containing 15 per cent sulphuric acid by volume. The pickling solution remaining on the wire is neutralized by immersing the coils in a lime bath. The lime also serves as a lubricant for subsequent drawing and is a temporary rust preventive.

The coil stock is then cold-drawn to insure uniformity of wire diameter. The diameter of the wire is reduced up to approximately 15 per cent in this operation, depending on size. The operation is performed on standard drawing machines equipped with carbide dies. The diameter of the wire is made about two-thirds the diameter of the ball desired. For example, to produce 1/2-inch diameter balls, 0.393-inch diameter wire is cold-drawn to a diameter of 0.363 inch.

Surface hardness and strains set up in this cold-working operation are removed by annealing. For coils used in making 3/8-inch diameter balls, this second annealing operation is performed at 1130 degrees F., and twenty-four hours are required to heat, "soak" at temperature, and cool the coil stock. Another mild,

Fig. 2. Coils of wire to be formed into balls are softened and made more ductile by annealing in this vertical, gas-fired furnace



drawn wire at left to lapped and polished ball at right

sulphuric acid pickling operation is then required for scale removal. Pickling is followed by a cold-water rinse, a hot-water rinse, and a hot-lime dip to neutralize any traces of the pickling acid and protect the wire from corrosion for a short period of time.

Rough-forming of balls from coil stock is accomplished on a battery of Waterbury-Farrel, National, and Manville single-stroke, cold-heading machines. The wire is fed into the heading machine, at regular intervals, by a pair of grooved rolls. The amount that the rolls rotate determines the length of wire fed through the cut-off die of the machine. This length should be two and one-half times the diameter of the wire. Final adjustment of the length of wire fed per stroke is accomplished by changing the position of the stop against which the wire is fed.

A cam-actuated cut-off knife shears the required length of wire by sliding across the face of the cut-off die. This slug is supported during the shearing operation by an auxiliary knife. The slug is pushed from between the knives into a slug carrier, which transfers it to a position between the two forming dies, Fig. 3. These heading dies consist of cylindrical blocks with hemispherical impressions sunk in their faces. One die reciprocates, while the other is stationary. The sliding die is momentarily halted when it presses the slug against the stationary die to permit the slug carrier to be retracted from between the dies. The sliding die then continues its advance to compress the slug into a ball shape.

Knock-out pins are provided in the center of the impression on both dies, to eject the formed ball from the dies. The ends of these pins are flush with the surfaces of the impressions at the beginning and end of the knock-out stroke. By carefully controlling the diameter of the wire in the cold-drawing operation, and the length of the slug in the shearing operation, the rough-formed balls are produced with a minimum of excess metal or flash forced out from between the dies.

Diameter of the forged balls is maintained within plus or minus 0.003 inch.

These high-production machines operate at up to 357 strokes per minute. Life of the forming dies varies—from about 20,000 balls 17/32 inch in diameter to 50,000 balls 7/32 inch in diameter. The dies cannot be resharpened, but are occasionally re-sunk for use in producing larger diameter balls. Lubricating oil is applied to the coil stock to facilitate forming.

Stresses set up in the balls by the cold-heading operation are relieved by a normalizing heat-treatment. Continuous cycle, rotary type gas-fired furnaces approximately 4 feet in diameter by 10 feet long are employed for this operation. A revolving cylinder having a helical baffle along its inner periphery carries the balls through the furnace at a pre-selected rate. The balls are cooled in air at room temperature. Each normalizing furnace is capable of treating 500 pounds of balls per hour.

Flash is removed from the rough-formed balls on special vertical-spindle grinding machines designed by New Departure. One such machine is shown schematically in Fig. 4. Balls are fed into the machine from a hopper which holds

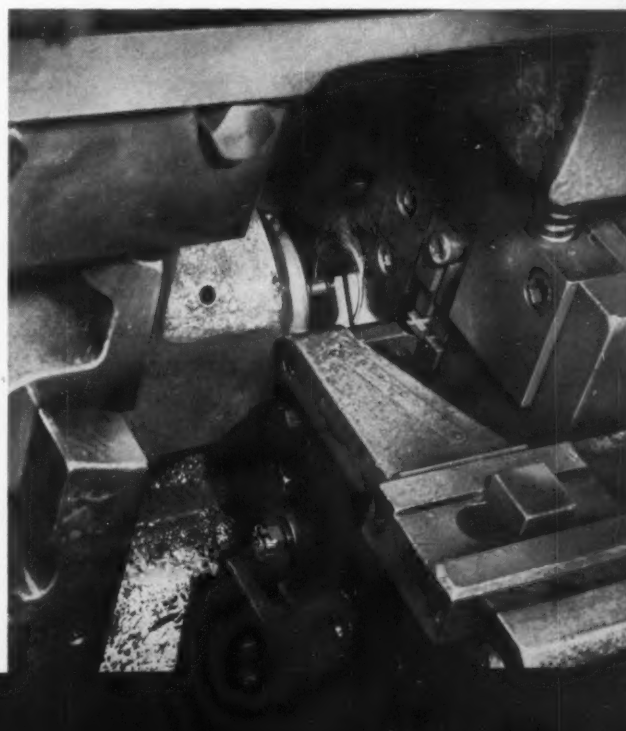


Fig. 3. Close-up of the cold-heading machine showing sheared slug raised to a position between the forming dies by a slug carrier

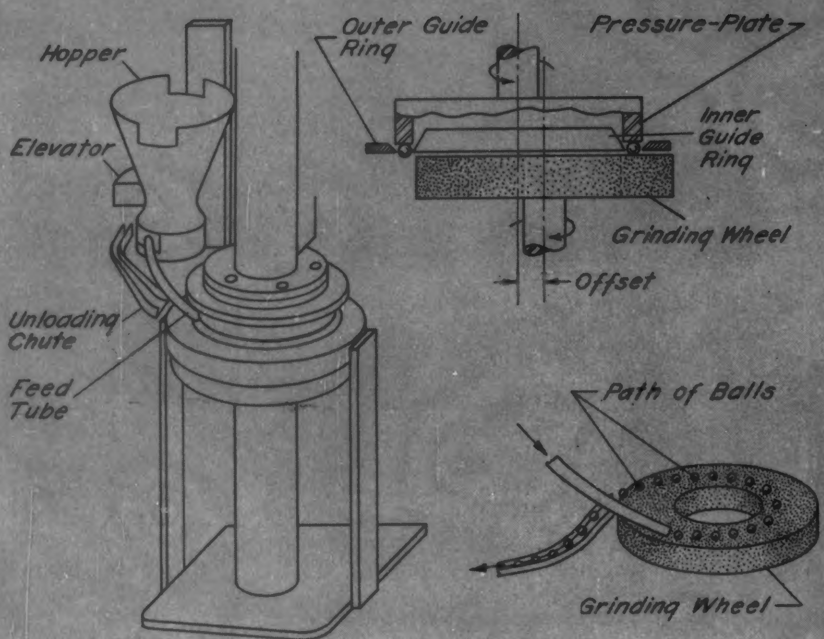


Fig. 4. Flash is ground from cold-headed balls on this special vertical-spindle machine (shown schematically). The balls are fed into the machine from a hopper

about 250 pounds. A grinding wheel (24 inches in diameter by 4 1/2 inches thick on one size machine), mounted on a vertical spindle, is rotated in a horizontal plane at 1200 R.P.M. A pressure plate, revolving in the opposite direction from the grinding wheel and mounted on another vertical spindle, off-center from the grinding wheel spindle, causes the balls to roll over the surface of the wheel. Inner and outer stationary guide rings confine the balls to a single-row circular path between the pressure plate and grinding wheel. The width of the annular space between inner and outer guide rings and the vertical distance between grinding wheel and pressure plate determine the size of ball to be flash-ground.

Cold-headed balls for the 3/8-inch diameter size are from 0.027 to 0.033 inch over size on their diameters. From 0.002 to 0.012 inch of stock is removed in flash-grinding, resulting in the ball diameters being from 0.021 to 0.025 inch over size after grinding. The balls are automatically recirculated through the flash-grinding machine until they have reached the desired diameter, within plus or minus 0.002 inch. Each ball goes through the grinding cycle an average of three times. The amount of stock removed from each ball per grind can be regulated by adjusting the pressure with which the ball is held against the grinding wheel. The pressure is measured by an ammeter, which indicates the loading on the grinding-wheel spindle motor.

Production from each flash-grinding machine varies up to about 100 pounds of balls per hour, depending upon the size ball being ground and the amount of stock removed. A hard aluminum oxide grinding wheel of 46 grain size, Z grade, and vitrified bond is employed for flash-grinding. The average life of such wheels is approximately 12,000 pounds of balls.

Balls from which the flash has been removed are rough-ground on specially designed, centerless type grinding machines. Prior to rough-grinding, the balls are screened to eliminate those over size. About 0.020 inch of stock is removed from the diameters of the 3/8-inch balls during rough-grinding, holding size and out-of-round within plus or minus 0.0005 inch. The ground balls are within 0.005 inch of the finished size.

Like conventional centerless grinders, this special machine contains a grinding wheel and a regulating wheel. The peripheries of both wheels have a number of grooves, lying in planes perpendicular to the center lines of the wheels. The radii of the grooves progressively decrease from one side of the wheels to the other, so that the diameter of the ball is reduced as it is transferred from groove to groove by a shuttle mechanism.

The balls travel from a hopper on the rough-grinding machine, through a feed-tube, to a bronze ball guide, as seen in Fig. 5. This guide serves to direct the balls as they are shuttled from one groove location to another in front of the wheels, and to guide each ball as it is pushed into and out of the grinding position between the grinding wheel and regulating wheel.

Hydraulically operated front and rear pins, respectively, push the balls into and out of the

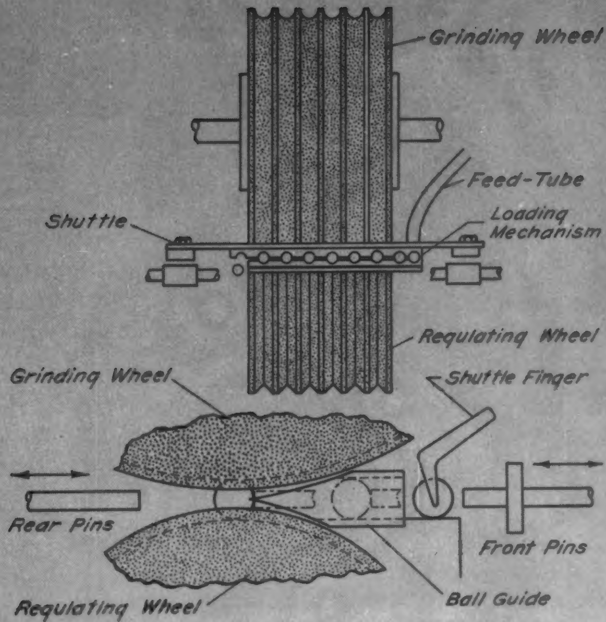


Fig. 5. Drawing of loading and shuttling arrangements on a special centerless type grinding machine in which the balls are rough-ground

grinding position. The number of pins, both front and back, is the same as the number of groove pairs in the grinding and regulating wheels. This number varies from five to fifteen, depending upon the ball size and the amount of stock to be removed per groove. The round pins pass through the guide, picking up and returning a ball with each forward and return stroke, as seen in Fig. 6. Speed of operation varies up to forty strokes per minute, depending upon the ball size.

The shuttle, consisting of a series of fingers mounted on a tilting fixture, automatically drops between the balls when the balls have been ejected from the grinding positions by the pins. The shuttle is then moved sideways to transfer each ball to a position in line with the next pair of pins and grooves, lifted clear of the balls, and returned to its original position. When each ball is ejected from the grinding position in the final pair of grooves, it drops into a flexible chute leading to a ball gage.

Approximately one out of every twelve rough-ground balls is automatically picked up by the ball-gage carrier and passed between gaging surfaces. If the electrical gage determines the ball to be over size, it automatically feeds the grinding wheel downward the required amount. Groove wear on both grinding and regulating wheels is thus compensated for, and ball size is automatically maintained within the specified tolerance.

Optimum groove depth is approximately one-third the diameter of the ball being ground. As the grooves wear deeper, the rolling action of the balls is retarded and the balls are ground out-of-round. It is necessary, therefore, to periodically dress the grinding wheel and replace the regulating wheel. The outer periphery of the grinding wheel, consisting of the lands between the grooves, is dressed about once a day, or after

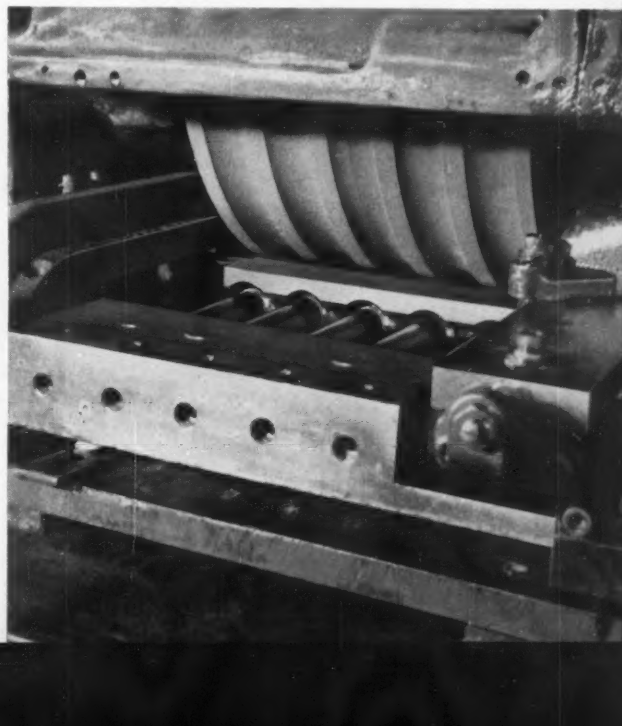


Fig. 6. Close-up view of centerless grinder. Balls seen behind guide are being automatically shuttled to left. Pins in front of guide push balls into grinding position

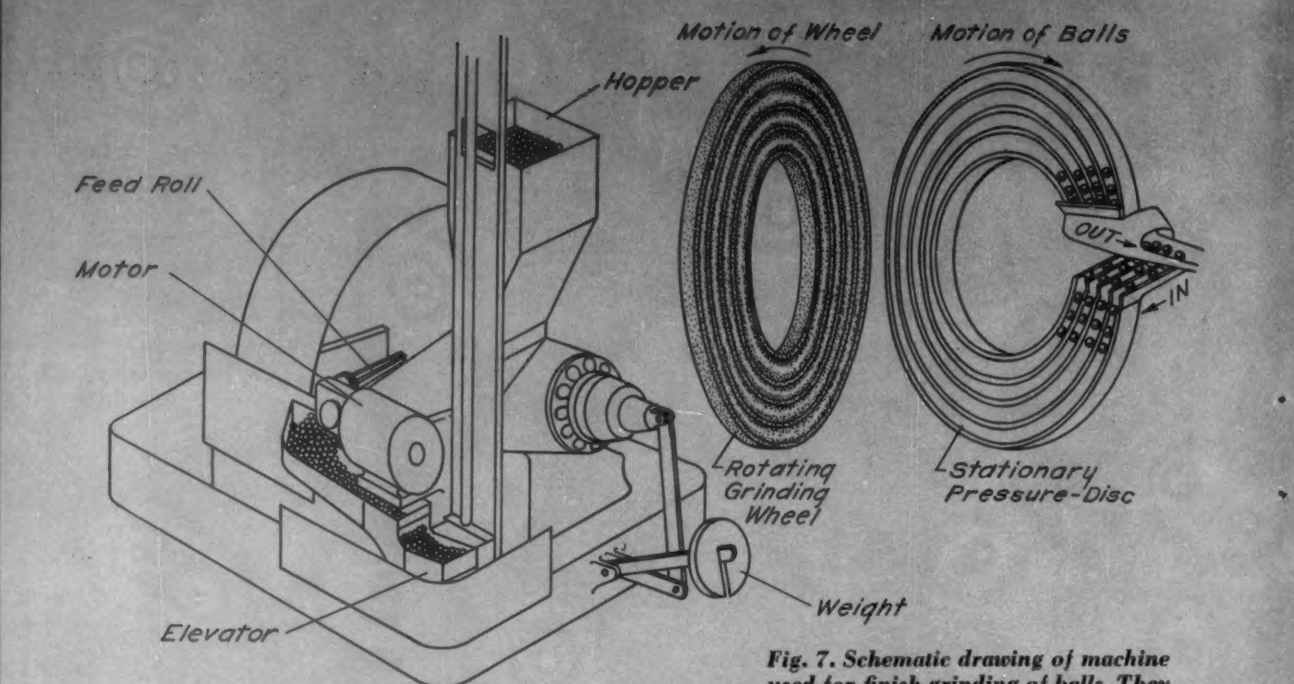


Fig. 7. Schematic drawing of machine used for finish-grinding of balls. They roll between a rotating grinding wheel and a stationary cast-iron disc

about 0.010 inch of wheel wear. The grooved regulating wheels are made from chromium-plated, hardened steel and consequently have quite a long life.

As the grinding-wheel diameter is decreased from wear and repeated dressings, its rotational speed is increased to maintain a surface speed of 6000 feet per minute. New wheels on one size grinder are 24 inches in diameter by 10 inches wide, and are rotated at 960 R.P.M. The regulating wheel is revolved at 600 surface feet per minute. A hard aluminum oxide grinding wheel of 80 grit, W grade, and vitrified bond is employed for this operation. Approximately 18,000 pounds of balls can be ground before the grinding wheel must be discarded.

Rough-ground balls are hardened in a continuous cycle, natural gas-fired furnace, heated to a temperature of 1470 degrees F. About 325 pounds of balls are hardened per hour, the balls

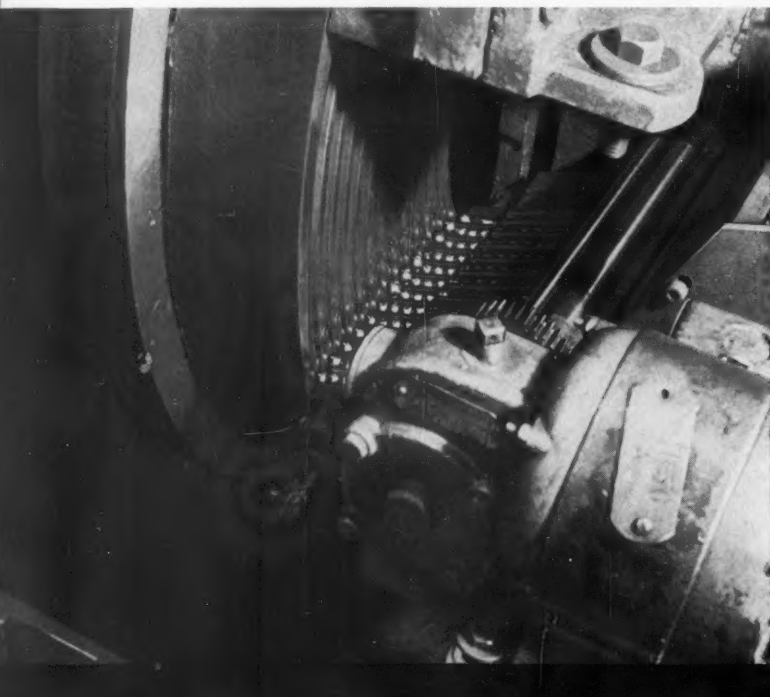


Fig. 8. Close-up view of the feeding unit on finish-grinding machine seen in Fig. 7. The unit spaces and directs balls between grooves on faces of grinding wheel and pressure disc

passing through the furnace in from twenty-four to twenty-seven minutes. The balls fall from a hopper onto a shaker type hearth. The stepped hearth is drawn back, against spring tension, by means of a Reeves variable-speed control unit, and then allowed to return by action of the springs, against a lead bumper. This bumping action causes the balls to roll over consecutive ridges on the surface of the hearth, thus exposing all surfaces of the balls to the heat and moving the balls through the furnace. Speed of the bumping mechanism is increased when heating larger balls, and decreased for smaller balls.

Balls up to 1/2 inch in diameter are quenched in oil, while larger balls are quenched in water. Water, of course, is the faster cooling medium, but it is too severe a quench for the smaller balls. Both quenching mediums are maintained at a temperature of 100 degrees F., within plus or minus 10 degrees, by means of a cooling unit. Resulting ball hardness is about 63 Rockwell C with an oil quench, and 64 with a water quench.

To reduce the brittleness of the hardened steel balls, they are tempered at 250 degrees F. for thirty minutes in a Leeds & Northrup Homocarb furnace. The balls are placed in pots which are lowered into the vertical, pit type electrically heated furnaces. A fan in the bottom of the furnace draws hot air from the top of the furnace through a load of balls. Hardness of the balls is reduced to about 62 or 63 Rockwell C, but a much tougher, less brittle product results.

Hardened, tempered, and screened balls are finish-ground on special horizontal-spindle grinding machines such as the one shown schematically in Fig. 7. The balls roll around a circular path in a vertical plane, between a concentrically grooved, revolving grinding wheel and a similarly grooved, but stationary cast-iron disc. Approximately 0.005 inch of stock is removed from the 3/8-inch diameter balls in this operation, bringing them to within 0.0003 inch of the desired size. Out-of-roundness of finish-ground balls is maintained within 0.0004 inch.

A hopper on this finish-grinder holds from 160 to 235 pounds of balls, depending upon their size. The balls roll down a chute, from the hopper to a feed unit, which spaces and directs them between the multiple, concentric grooves on the faces of the grinding wheel and the C-shaped, cast-iron pressure disc, as seen in Fig. 8. The grinding wheel, 32 inches in diameter by 4 inches thick and rotating at 64.6 R.P.M. on one size machine, "picks up" the balls from the guide and carries them in a circular path between the grooves.

After rolling once around the pressure disc, the balls are directed into a chute by a shedder bolted to the stationary disc. The chute carries the balls to an elevator bucket which automatically returns them to the hopper. It requires up to 240 cycles through the machine to finish-grind certain size balls, resulting in a production of from 18 to 20 pounds per hour. Weights, exerting pressure on the stationary cast-iron plate through a system of levers to keep the balls in contact with the grinding wheel, are removed gradually as the diameters of the balls diminish.

Two types of abrasive wheels are used interchangeably for the finish-grinding operation. One, a softer wheel made from aluminum oxide abrasive, has a relatively short life (capable of grinding about 8500 pounds of balls) but is easy to dress. The other, a harder wheel made from

Fig. 9. A leather-lined tumbling barrel which contains loose pieces of cloth is employed for final cleaning and burnishing of the steel balls. A finish of less than 1 micro-inch is obtained

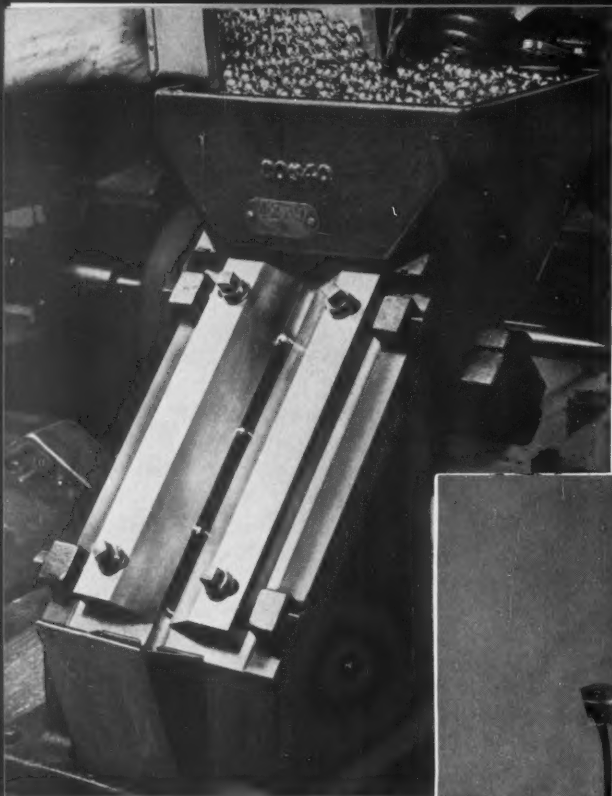


Fig. 10. (Left) Balls are sorted into classifications, varying from each other by only 0.000025 inch, by means of this gravity-operated ball-gaging machine

Fig. 11. (Right) Instrument for inspecting the sphericity of finished steel balls, and plotting the results graphically on a circular chart

silicon carbide abrasive, lasts for about 40,000 pounds of balls but is more difficult to dress. Both wheels are of 400 grain size, Z grade, and vitrified bond. Full-strength mineral seal oil is used as the cutting fluid for the grinding operations.

The balls are then polished and lapped by an operation performed on the same type of machine employed for finish-grinding. A revolving cast-iron plate is substituted for the grinding wheel, and the balls roll between this grooved plate and the stationary pressure disc. Fine (500 grain) unfused aluminum oxide abrasive is added to the load of balls in the hopper of the machine to charge the rotating plate and stationary disc. About 0.0003 inch of stock is removed, and a highly polished surface is produced on the balls in this operation. Diameters are maintained within plus or minus 0.000025-inch, and out-of-round does not exceed 0.000025 inch.

Abrasive, oil, and dirt are removed from the balls by tumbling them in a wooden barrel containing ground corncobs. The balls are then tumbled in a leather-lined barrel containing loose pieces of cloth, Fig. 9, for further cleaning and burnishing. A surface finish of less than 1 microinch r.m.s. is imparted to most balls, and the operators wear gloves to prevent finger marks from staining the balls.

Final inspection is performed in a special room in which the temperature, humidity, and light intensity are maintained uniformly constant. Samples from each lot of balls produced are visually checked under a 36-power microscope. All balls then undergo a visual inspection, seen in the heading illustration, which is accomplished by slowly rolling the balls on a composition tray, under fluorescent lights, using a white celluloid card to rotate the balls. Light is reflected from the balls in such a way as to show small defects otherwise invisible to the naked eye. Out-of-

round balls flash light when they are rolled. So-called "fire" cracks, developed in hardening, are cause for scrapping. Balls containing faint surface marks or small pits are re-worked to a smaller size.

Inspected balls are sorted into classifications. Consecutive classifications vary from each other by only 0.000025 inch, and sorting is accomplished on the gravity ball-gaging machine seen in Fig. 10. Balls, placed in the hopper at the top of the machine, roll down the inclined steel straightedges. This pair of lapped straightedges are accurately spaced to be slightly further apart at the bottom than at the top. Each ball drops between the straightedges at that location where the space between them becomes greater than the diameter of the ball, falling into a chute leading to the correct size classification container.

Balls selected at random from each container are checked for size and sphericity by rotating them between anvil and stem of a precision dial-indicator gage graduated in millionths of an inch. A new means of checking ball sphericity is the Taylor-Hobson Talyrond precision instrument seen in Fig. 11. On this unit, the sphericity of the ball being inspected is plotted graphically. Satisfactory balls are then oiled, packaged, and labeled, and sent to the assembly department.

Low-Cost Mandrels for Tube Bending

TUBE benders at Temco Aircraft Corporation, Dallas, Tex., are equipped with ball type mandrels that cost less, set up more quickly, and form more efficiently than conventional tools of this type. Development of the tools resulted from a requirement for forming tight-radius bends in 2- and 3-inch diameter aluminum tubing. Bending was first tried with a straight, plug type mandrel. However, this method left the tubing unsupported where the bend was made, and the tubing tended to flatten. As a result, 20 per cent of the parts bent in this manner were distorted and had to be scrapped.

The tool designed has dished-out steel hemispheres nested in series on the end of a shank to make a mandrel extension which curves in conformance with tubing. The spheres and shank are strung on a length of 3/16-inch cable. A shank type terminal is swaged on one end of the cable, and a ball terminal on the other end. Thus, the mandrel can swivel in any direction.

In setting up the mandrel for use on a tube-bending machine, the cable saves time, since it leaves the mandrel free to swivel. In addition, because the mandrel can be swiveled through 360 degrees, it is assured of constant alignment with the radius-block.

The tool is designed for quick adaptation to bends of large or small radius. The smaller the radius, the more balls are needed. By using a cable of appropriate length, from two to five balls can be strung.

Inexpensive ball type mandrel developed for forming tight-radius bends in aircraft tubing. Mounted on the mandrel rod in this Pines tube-bending machine is a mandrel for 2 1/2-inch tubing

Accurate Contouring with Versatile Hydraulic Tracer

A VERSATILE, high-pressure hydraulic tracer capable of controlling very heavy, slow cuts, as well as light fast cuts, has been developed by the Gisholt Machine Co., Madison, Wis. Called the Jetracer, the device consists of a separate slide and control unit mounted on the carriage of a machine, and actuated by a stylus following a flat cam or template. Templates can be mounted at the back of the machine when the tracer is located on the rear carriage or at the rear of the cross-slide; on an overhead bar when the tracer is placed on one of the turret faces of a machine; or on a four-sided indexing drum at the front of the machine when the tracer is mounted on the front carriage.

The Jetracer can be used with ram or saddle type turret lathes, Fastermatic automatic turret lathes, Simplimatic automatic lathes, and other machines. A single-point cutting tool, mounted on a sliding member of the machine, will turn, face, or bore—either straight, tapered, or contoured surfaces. Where the diameters of the workpiece surfaces are increasing, the tracer will permit facing 90-degree shoulders; and where decreasing, 30-degree shoulders. Accuracy of the work produced will depend on the machine, and the method of tooling the job. The tracer itself is accurate to plus or minus 0.0005 inch.

In Fig. 1, the Jetracer is shown mounted on a No. 5 turret lathe. Here, the tracer slide and control unit have been mounted on the rear of the standard cross-slide of the lathe. A stylus on the tracer slide follows the template located on the back of the machine, as seen at the lower right. Movement of the stylus changes the pressure balance within the tracer unit, and, in turn, causes the slide to move in the same direction as the stylus. This turret lathe is set up to machine end-mill arbors. Drilling, countersinking, and tapping operations are performed in the conventional manner with tools mounted in the hexagonal and square turrets of the lathe. Contour turning of the outer surfaces on the arbor is controlled by the tracer unit and template.

The Jetracer slide and control unit have been mounted on one of the hexagonal turret faces of a 2L saddle type turret lathe in the set-up illustrated in Fig. 2. In this case, the stylus on the tracer slide follows a template mounted on an overhead bar. For contour boring operations, the hydraulic tracer would be mounted at the rear of the cross-feeding hexagonal turret.

The template for the Jetracer has been mounted at the front of the Gisholt hydraulic, automatic lathe seen in Fig. 3. Tracer slide and control unit are secured to the front carriage for turning five outer surfaces and facing their connecting shoulders on a multiple-diameter shaft held between centers in the lathe. Tools mounted on the rear slide face and chamfer the workpiece.

A feature of the hydraulic automatic lathe

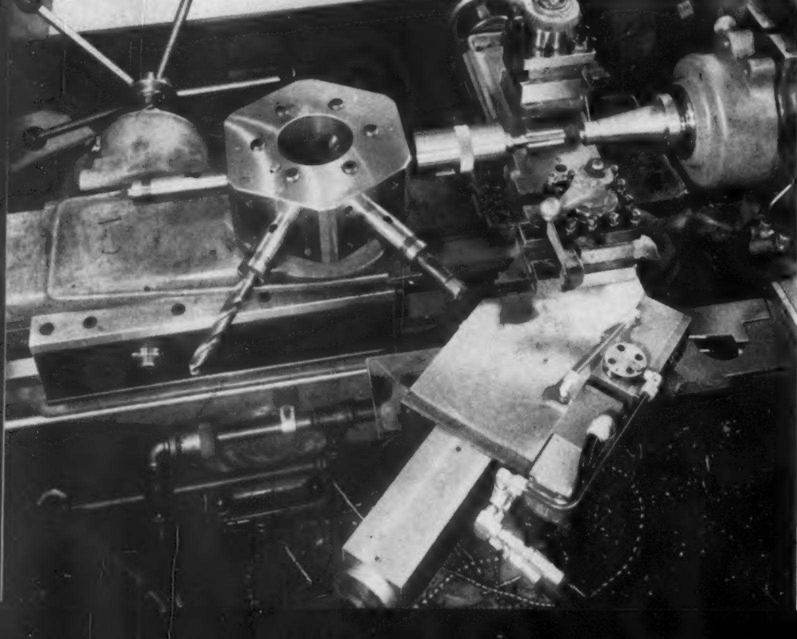
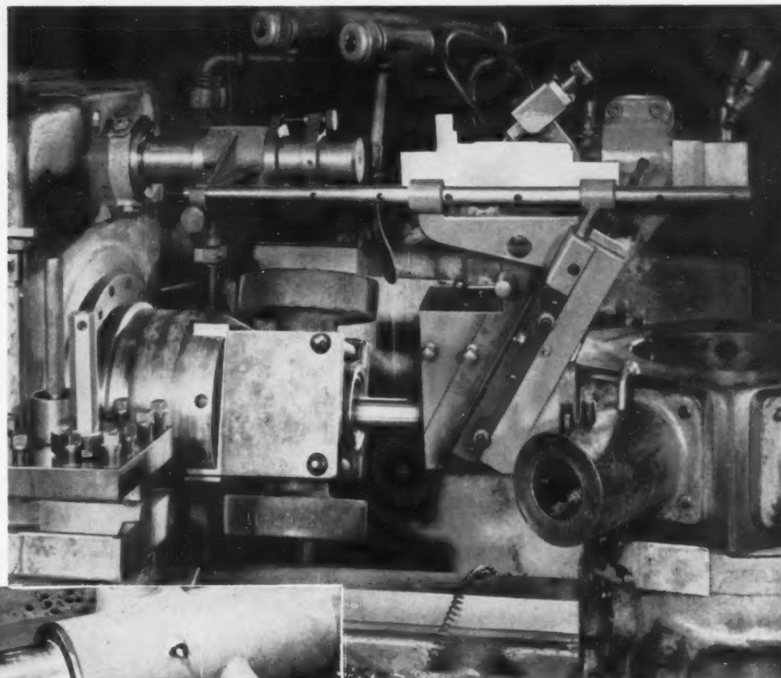


Fig. 1. Template mounted on back of this ram type turret lathe controls contour turning of end-mill arbors. The tracer slide and control unit are located at the rear of the lathe cross-slide

Fig. 2. (Right) Face of hexagonal turret is used to mount hydraulic tracer slide and control unit on this saddle type turret lathe. The template is placed on an overhead bar



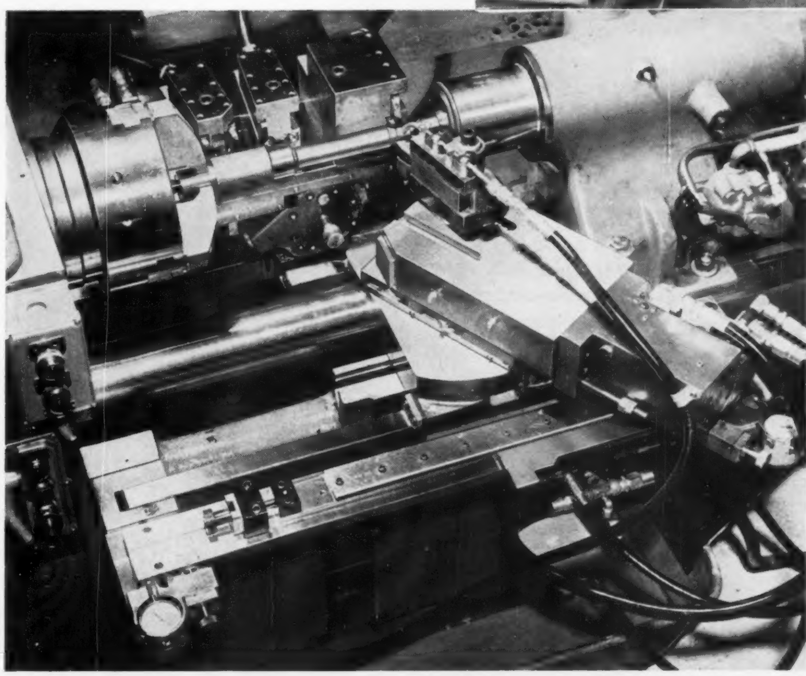


Fig. 3. (Left) Hydraulic automatic lathe has front-mounted template, with tracer slide and control unit located on the front carriage, for turning and facing multiple-diameter work-pieces

shown in Fig. 4 is a four-position, indexing, template drum, mounted along the front of the machine. In this set-up, the tracer slide on the front carriage supports two tools. One is employed for turning two different surfaces on a shaft, and the other, a large diameter flange on the same work-piece. Tools on the rear slide are used to face and chamfer the part. Additional templates can be mounted on the other three faces of the indexing drum to handle other jobs.

Another advantage of the hydraulically operated indexing drum is that up to four templates can be mounted on the faces of the device for performing automatic, successive tracer passes on the same work-piece. In this way, time is saved by eliminating needless tool travel; tool life is extended by minimizing the stock removed per pass; and one operator can easily handle two or more machines. With such set-ups, the stylus on the tracer slide follows only the template that has been automatically indexed to its top position. The tracer may be set to travel the entire length of any or all templates, or any portion of their lengths.

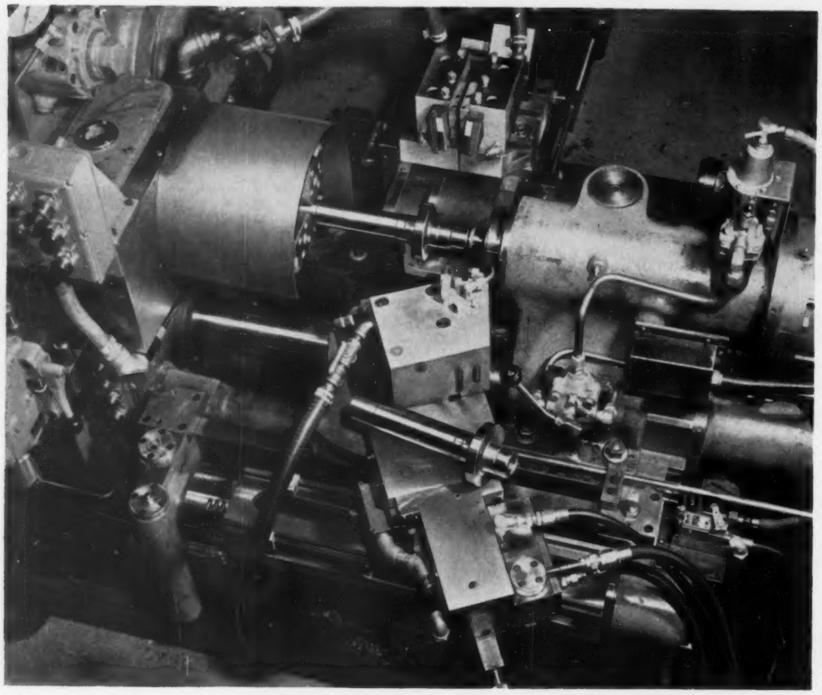
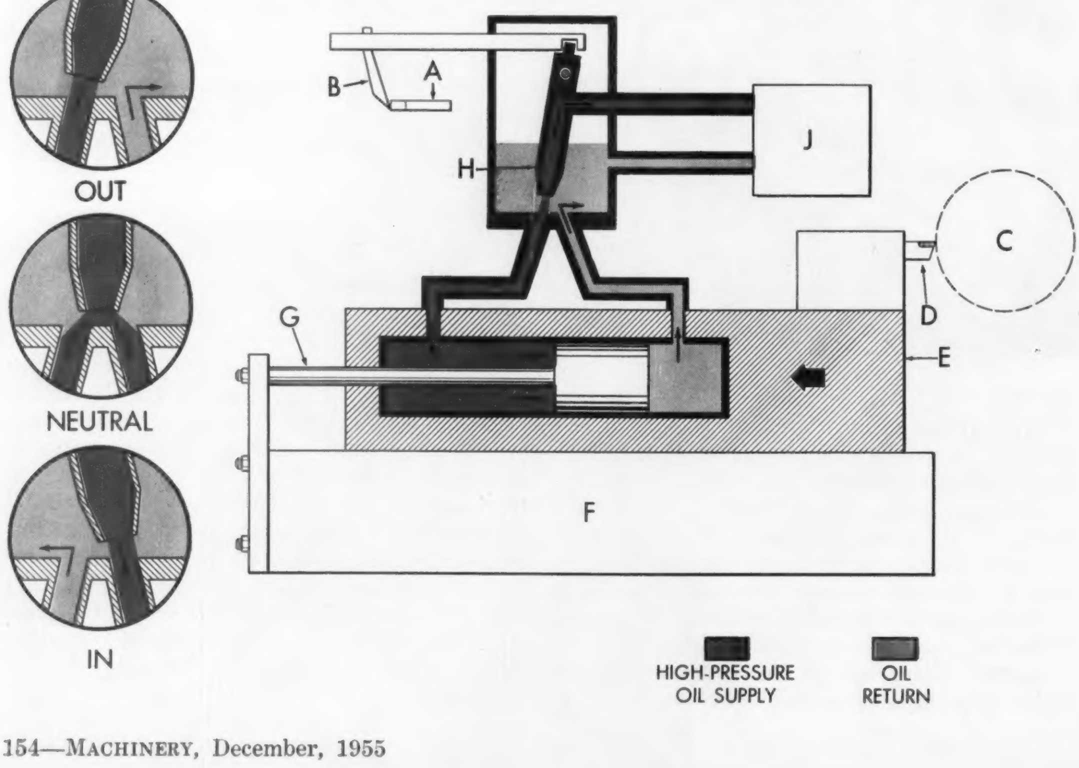


Fig. 4. Four-position indexing drum, seen along front of this automatic lathe, permits the use of from one to four templates for performing successive tracer passes on work

Fig. 5. High-pressure oil from supply tank (J) is directed to either one or both sides of piston according to the position of jet nozzle (H), which is controlled by stylus (B) in contact with template (A)



A schematic, cross-sectional drawing of a Jetracer is seen in Fig. 5. The template is indicated at *A*, the stylus at *B*, the work-piece at *C*, and the single-point cutting tool at *D*. The tool-holder is mounted on a tracer slide *E* which is free to move along ways provided on a fixed base *F*. The piston-rod *G* is secured to a plate at one end of the fixed base, so that when high-pressure oil is applied to the left-hand end of the piston, slide *E* will move to the left, away from the work. When the contour of the template causes the stylus to pivot the jet nozzle *H* to the position shown at the lower left, high-pressure oil is directed against the right-hand end of the piston. This moves the slide and cutting tool to the right, toward the work. The neutral position of the jet nozzle, with which there would be no movement of the tracer slide, is seen in the inset at the left center.

Oil is supplied to the Jetracer from a tank *J*. Both a high- and a low-pressure pump, directly driven from a 2-H.P. motor, deliver oil to the tracer. Cylinders for the Jetracers are built in four sizes, varying from 1 3/4 to 5 inches in diameter, depending on the application. The largest cylinder is capable of moving the tracer slide from 12 to 15 inches per minute, with a depth of cut in the work of 3/4 inch and a feed rate of 0.035 inch per revolution. With the smallest cylinder, the slide can travel at a rate of 65 to 85 inches per minute, with a depth of cut of 3/8 inch and a feed of 0.025 inch per revolution.

Plastic Vacuum Fixture for Milling Odd-Shaped Parts

USE of a plastic fixture that holds odd-shaped pieces by vacuum has enabled Chance Vought Aircraft, Inc., Dallas, Tex., to do a faster, less expensive job of milling. The innumerable odd-shaped castings required in the aircraft industry would have to be set up and clamped separately if ordinary methods were employed.

A phenolic resin block is cast with the top center portion patterned from a production part. Attached to a steel lead-in pipe in the lower part of the block is a hose through which the vacuum is formed by suction. Standard O-rings are cast in place to provide a seal.

Original set-up time for this type of plastic fixture was about twenty minutes for one particular casting. Subsequent parts required only six seconds apiece to secure them in the fixture, which is clamped to the bed of a milling machine. Tests have indicated that the vacuum block is suitable for climb-milling. Up to 50 per cent savings over the conventional milling fixtures have been claimed for the new fixtures, which require no tool designing.

Cast phenolic block is used to hold odd-shaped castings by vacuum during milling. Suction through the air line at the lower left holds the casting in place, and the fixture is clamped to the bed of the machine.

Television Sets Cost Less Because of Automation

Automatic assembly, coupled with printed circuits and dip soldering, has enabled Admiral to improve the quality while substantially lowering the cost of television receivers

By C. S. Rossate
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TODAY, Admiral Corporation produces a 21-inch table model television receiver priced at $169.95. The company's first television receiver, introduced in 1947, had a 10-inch screen and retailed for $350. In other words, a much improved set having more than five times the picture area can now be purchased for less than half the cost. This achievement, accomplished in the face of rising labor and material costs, is the direct result of simplified product design and automation in manufacturing.

Until recently, the radio-television industry was essentially a screwdriver and soldering iron operation involving numerous manual assembly jobs. For example, there formerly were well over 1000 individual soldered connections in a 21-inch television receiver. The first step taken about three years ago to speed this slow and costly procedure was dip soldering, in which the hand-wired assemblies are dipped in molten lead solder.

Then, the intricate maze of wiring that required skilled, manual assembly was simplified by redesign and the adoption of printed circuits. Printed circuits were successfully pretested in over 250,000 radios during a two-year period before their application was extended to television receivers in June 1954.

Now, the latest step in automation has been achieved by the development of automatic assembly equipment capable of inserting and securing various electrical components, such as resistors, condensers, tube sockets, and terminal pins, in the circuit panels. This important accomplishment was the result of thousands of hours of research work, an investment of over $500,000,

and the redesign of many television components so they would fit into the feeding chutes of the automatic machines.

Evidence of the effectiveness of these developments is the new 1956 Admiral television receiver. Each receiver contains three printed circuit panels representing between 75 to 80 per cent of the total wiring in the chassis. The three panels contain 231 electrical components, including thirteen tubes, of which 175 parts—or 76 per cent—are automatically inserted by the new machines. Also, the components in each panel are soldered in a single dip, compared with 428 hand-soldered connections formerly required with manual assembly methods. The increased use of printed circuits insures more uniform quality, trouble-free soldering, and easier servicing in the field. The reliability of printed circuits was forcibly demonstrated when only twenty-four panels had to be returned to the factory out of the more than 250,000 produced for radios in 1952.

Printed circuit panels for the television receivers are made from copper-clad plastic sheets. The plastic base for each panel contains paper filler sheets impregnated with phenolic resin, while the cladding is 0.0015-inch thick electrolytic copper foil. Panels are produced in multiple, building up each panel between stainless-steel plates into a vertical stack. The stack contains, in sequence, impregnated filler sheets, an adhesive layer, copper foil, and a stainless-steel plate, repeated to obtain the number of panels needed.

Curing is accomplished on a hydraulic press under carefully controlled temperature and pressure conditions. After curing, the stack is removed from the press, and the panels are stripped from the plates and trimmed to the desired size. Panels must be carefully inspected to insure that there are no scratches in the copper which would break the circuit. Also, the strength of the bond is tested, and a 1-inch square sample is floated in molten solder (maintained at a temperature of 450 degrees F.) for ten seconds to insure that it resists blistering.

The first step in producing a printed circuit is to make a glass master on which is inscribed an ink drawing four times the actual size of the required electrical pattern. The drawing is photographically reduced to a sharp, actual-size negative by means of a large camera, as seen in Fig. 1. A stiff sheet of Vinylite-base film is used for the negative to prevent distortion.

The wiring circuit on the negative used to be superimposed on the copper surface of the panel by the photoengraving technique. Now, however, this transfer is accomplished by the silk-screen process as it has been found to be more exact and less costly. First, the screen is impregnated with a light-sensitive material, and exposed to light under the negative. The pattern is developed on the screen by washing with water, which removes the light-sensitive material from the areas not hardened by the light. Hardened material is not washed off, and the screen becomes a stencil of the required pattern.

The screen is placed on the copper surface of the panel in a silk-screen press, and an etch-resistant ink is applied to the screen surface. Open lines on the screen, representing the required wiring circuit, permit the ink to pass and coat the copper surface. The areas on the screen formed by the hardened light-sensitive material, however, are impervious to the ink, and the copper directly under these areas is not coated. Then, when the panel is immersed in the etching tank containing a ferric chloride solution, all the copper is dissolved except the lines protected by the ink. Thus, the completed panels have the required network of permanently attached copper, connecting various terminal points and eliminating the need for wiring.

Previously, with the photoengraving technique, the copper surface of each panel had to be individually sensitized, dried in a whirler, and

Fig. 1. In producing a printed circuit, an enlarged ink drawing of the required electrical pattern on glass is reduced photographically to a negative.

Fig. 2. Etched panels are carefully inspected to make sure proper circuits exist. Corrections can be made by brushing stop-off lacquer on the panel.

placed in a dye vat. Now these steps have been eliminated, as the prepared screen can be applied directly to the copper and then reused. Printed circuits have eliminated improper connections which were always a problem with manual assembly, and saved many hours of wiring time.

After rinsing the etched panels to neutralize the ferric chloride solution, they are carefully inspected, as shown in Fig. 2, to insure no interlocking of circuits which might be caused by foreign particles such as lint on the negative or imperfections in the screen. Inaccuracies can be corrected at this point by painting the affected areas with stop-off lacquer.

Panels can be produced in multiple, such as the twelve-panel units seen in Fig. 2, or singly. The multiple units are cut and trimmed to the required size, and holes are punched in the individual panels to receive the various electrical components to be mounted on them.

Presses employed to punch the holes in the panels are equipped with automatic loading devices and thermostatically controlled electrical heaters. With this set-up, Fig. 3, the panels are preheated to a temperature of 175 degrees F. before being automatically fed into the press. As each panel enters the press, it trips a limit switch to start the cycle. All the necessary holes are punched in one operation, and the press is automatically unloaded. (One of the multiple-punch dies is shown in Fig. 4.) Then, the panels are sprayed with lacquer to protect them from corrosion.

The many electrical components such as re-

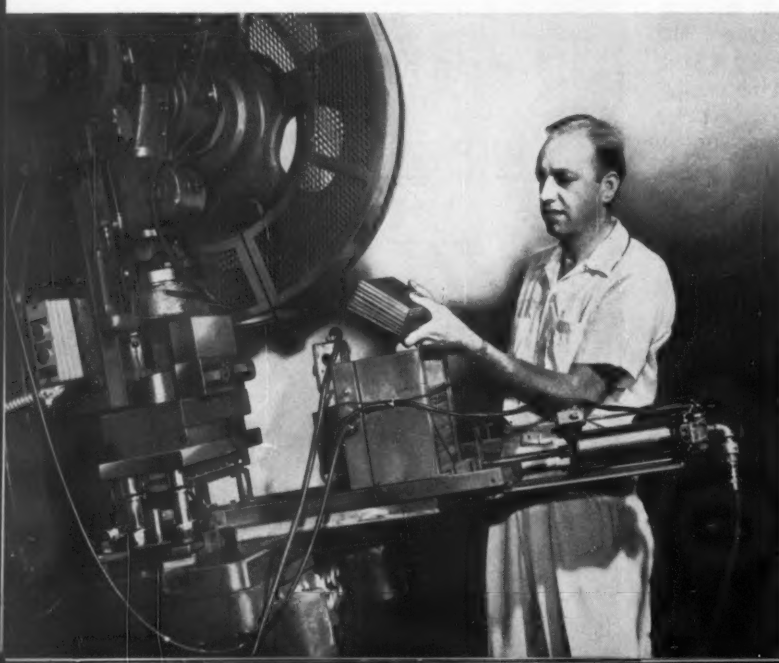

Fig. 3. Set-up for preheating panels to a temperature of 175 degrees F. and automatically loading them into a press for punching the various holes required.

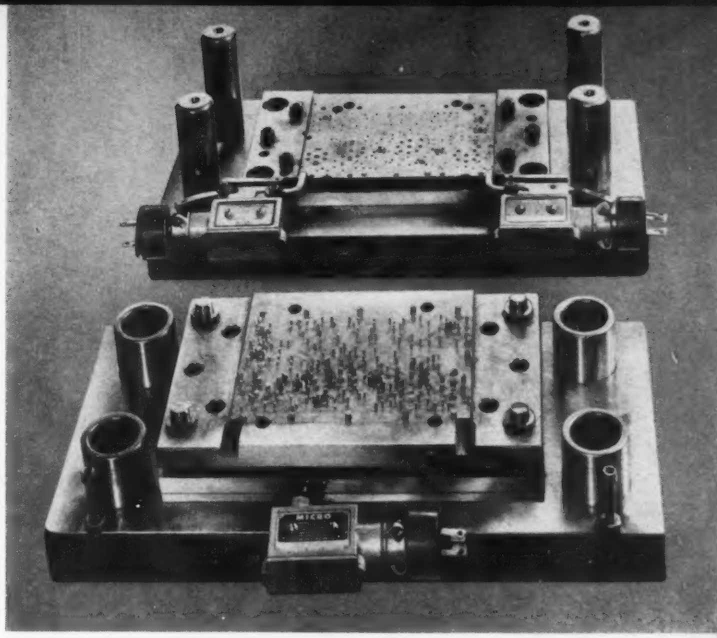

Fig. 4. All the holes required in the printed circuit panels for receiving the various electrical components are punched in one operation with the multiple die shown.

sistors, condensers, wire jumpers, and tube sockets that must be mounted on each printed circuit panel had to be assembled by hand before the automatic machines, such as the one seen in the heading illustration, were developed. The in-line automatic assembly machines consist essentially of a panel loading device, a transfer device and rails for pushing the panels from station to station, a holding plate with locating pins at each station, and a head at each station equipped with the necessary magazine loading devices and tooling for inserting the various components.

Both the transfer device and the individual heads at each station are operated by air cylinders. Automatic controls and interlocks are provided to insure proper sequencing. Whenever a part fails to feed from its loading device, a red light goes on at that particular head. Also, the entire machine is automatically halted until adjustments are made and the components again feed smoothly. This system minimizes the time required in locating trouble.

The first automatic assembly machine designed by Admiral had twenty-seven heads for inserting this number of components in each panel, and completed six panels per minute. Now, more heads are being added as required, and new heads capable of performing different operations are being developed. For example, the machine shown in the heading illustration has forty-four heads.

In operation, printed circuit panels are placed in the loading device at the front end of the machine, Fig. 5, and magazines full of the required components are placed in the feeding devices at each head. The panels are fed onto the rails with their printed circuit surfaces facing down, and indexed from station to station along the assembly line by the air-operated pushers. As each panel reaches a position under one of the heads, the transfer device halts momentarily, and a holding plate is automatically raised between the rails into contact with the panel for support during assembly. Pins on the holding plates

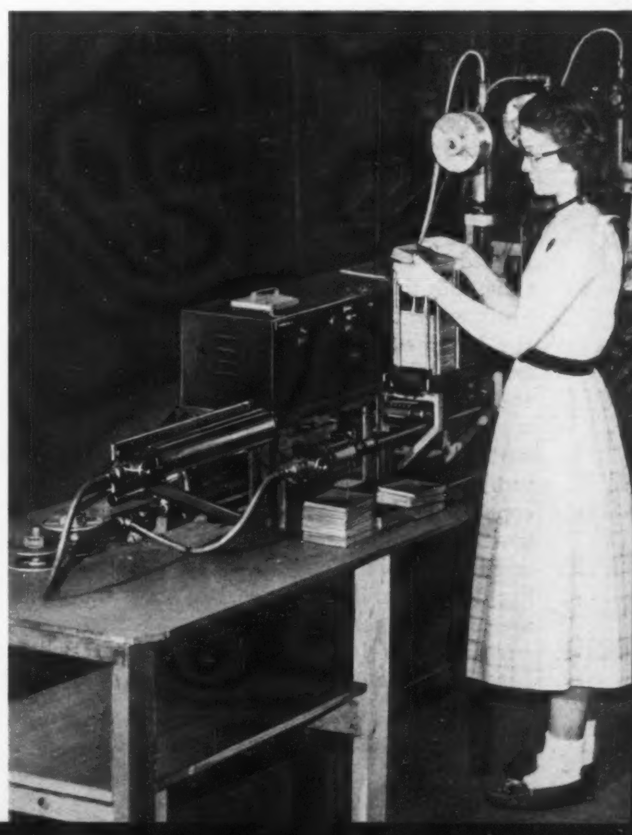

Fig. 5. Loading device at front end of automatic assembly machine (heading illustration) feeds panels onto rails with their printed circuit surfaces facing down.

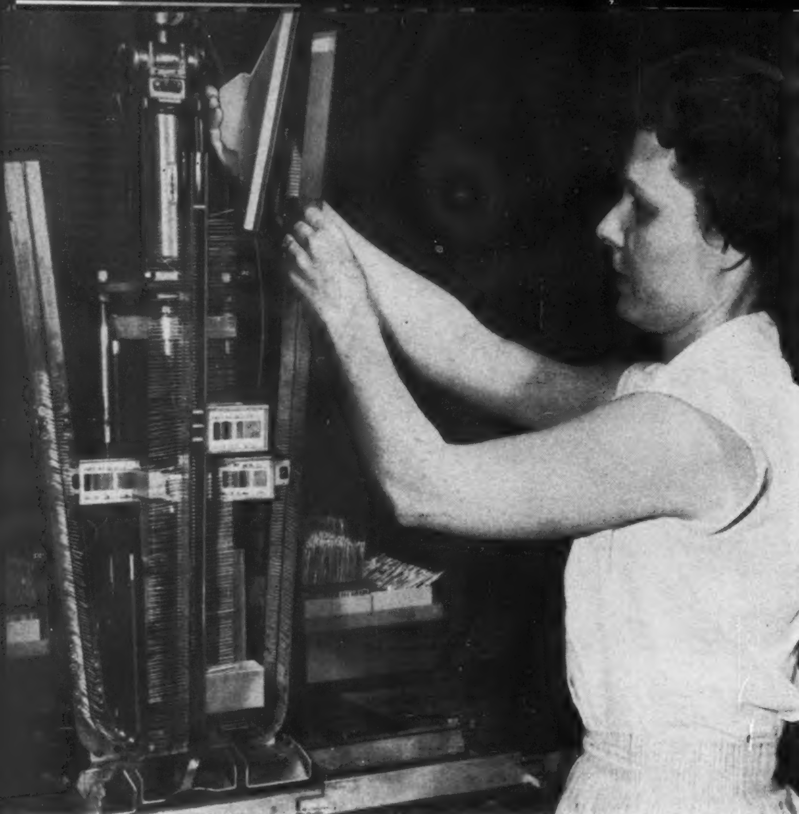

Fig. 6. Three magazines are mounted on this machine head for assembling three resistors into each panel. Only one air cylinder is required for this operation.

enter holes previously punched in the panels to insure accurate location.

While each head ordinarily inserts only one component into the printed circuit panel, some insert two, and others, three at a time. For example, Fig. 6 illustrates one head which assembles three resistors into each panel. This head has three magazine feeding devices, but only one air cylinder is required to assemble all three resistors. All heads are adjustable to accommodate different components, thus making the machine flexible to changes in product design. Also, the machine can be modified to take care of different size panels, and heads can be added or removed, as required.

The magazine feeding devices are accurately located so that the components drop, one at a time, into the proper positions on the panel. All heads operate simultaneously, and the tools on the lower ends of the air-cylinder piston-rods trim the wire leads to size where required, bend the leads to the proper spacing, and press the wires through the holes in the panels. An anvil built into each holding plate crimps the wires to hold each component in place and contact the copper circuit pattern on the under side of the panel. A close-up view of one of the heads is seen in Fig. 7. In this illustration, the magazine feeding device has been removed to show the panel and tooling clearly.

As the panel is indexed to each succeeding head, additional components are added. All that the machine attendant need do is keep the component magazines and panel loading device filled. At the end of the machine, the printed circuit panels, with up to 76 per cent of their components automatically assembled, slide onto a conveyor and are inspected. Then, the remaining components (such as tubes) are manually assembled. Tube sockets and condensers can now be assembled automatically. With continued research and development, it is believed that tubes will also be handled automatically.

Flux is applied to the printed circuit (copper) side of the panel, and this surface is dipped in molten lead solder, as seen in Fig. 8. The solder bath, 3 inches deep, is maintained at a temperature of 500 degrees F., and the panel is floated in the bath for approximately three to five seconds. This coats all of the copper lines on the panel—making the necessary connections between the crimped ends of the leads and the copper pattern, and preventing corrosion—but the solder does not adhere to the plastic surfaces of the panel. The panels shown in Fig. 8 each contain a total of sixty-nine resistors, condensers, coils, tube sockets, tubes, and other components.

In addition to saving time and cutting costs by eliminating hand soldering, this operation produces trouble-free connections that are not affected by vibrations or jarring. In Fig. 9 is illustrated a typical comparison between an old-style, hand-assembled, wired, and soldered tele-

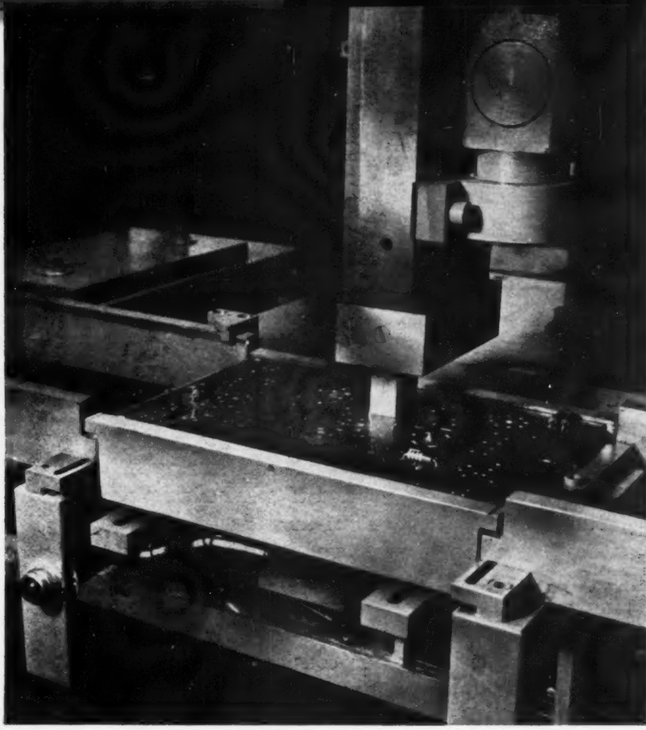

Fig. 7. Close-up view of another head on the automatic assembly machine, with the magazine removed to show the panel and tooling.

Fig. 8. A molten lead solder bath, held at 500 degrees F., is used to coat copper pattern and crimped leads on under side of panel.

vision chassis (left), and a simplified printed and dip-soldered panel (right). Production of printed circuit panels is more uniform, and engineering design can be more flexible. Also, the printed panels are more resistant to extremes of temperature and humidity. Faster checking can be performed, as printed circuits can be tested as a unit while hand-wired circuits may require from twenty-five to thirty individual checks.

Rather than displacing personnel, the automatic production lines in Admiral plants have made it necessary to hire more help. Increased employment has been caused by the setting up of a printed circuit department to produce these panels; additional help needed for final hand assembly due to increased output; the establishment of a department for developing, improving, and building the automatic production machines; the need for skilled technicians to regularly service and repair the equipment; and increased cabinet, packing, and shipping facilities. Most of the additional jobs require higher skills.

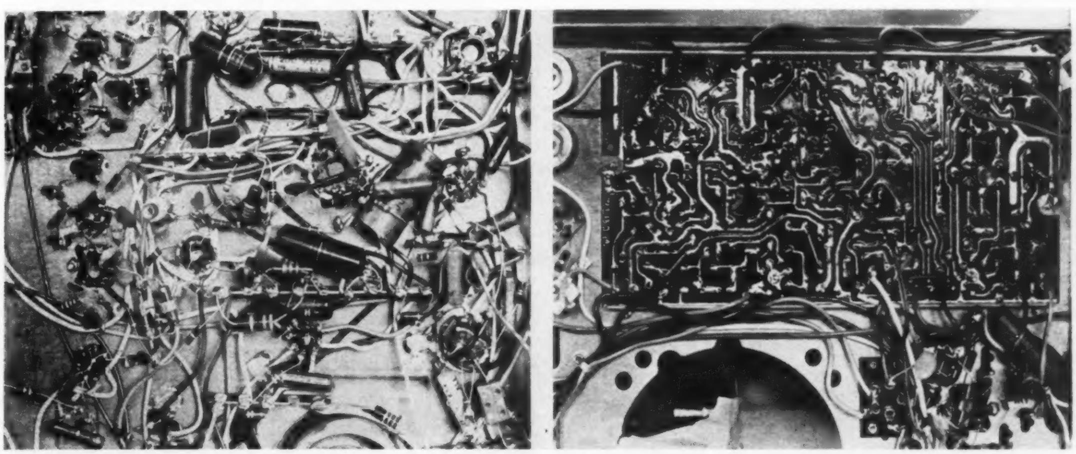

Fig. 9. Television chassis with wiring, assembly, and soldering done by hand is seen at left. Panel at right has a printed circuit and has been dip-soldered.

Inspecting Injection-Molded Nylon Gears

By L. D. Martin, Gear Consultant
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THE inspection of injected-molded nylon gears poses problems not encountered with metal gears. A great deal of care is necessary in taking measurements to assure that a given set of inspection conditions can later be duplicated. Nylon has the property of compliability, or resiliency, which causes it to resist deformation by springing back when applied pressure is released. For this reason, the practice of inspecting nylon gears by pin measurements raises some valid objections.

A series of tests completed by the writer showed conclusive evidence of the unreliability of pin measurements of nylon or other resilient gear materials. The test set-up is illustrated by the diagram in Fig. 1. Gaging spindle *A* was mounted vertically in an anti-friction bearing *B*, so that its weight was applied to measuring pin *C*. Indicator *D*, with 0.0001-inch graduations, had its tension spring removed so that the only additional pressure exerted against the gaging spindle was the weight of the indicator spindle. The combined weight of both spindles was 1 pound. This weight was considered realistic from a study made of pressures exerted by various inspectors using standard micrometers, as well as from actual measurements of micrometers equipped with pressure-sensing devices.

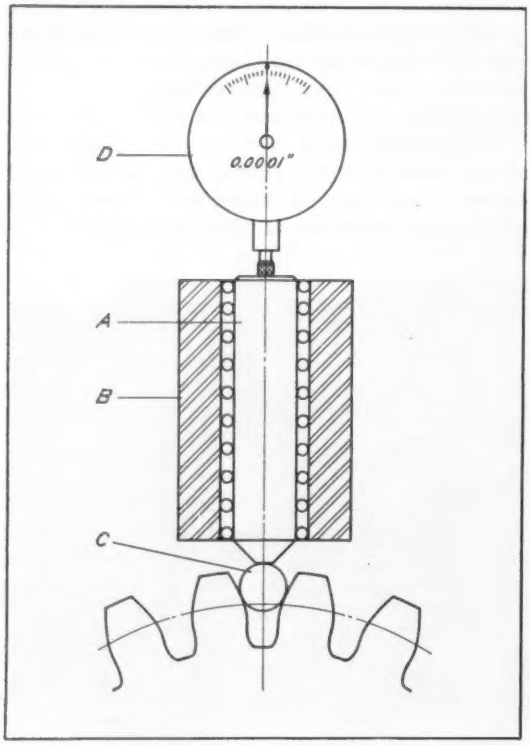


Fig. 1. The resiliency of the gear material made this pin-measurement inspection set-up unreliable.

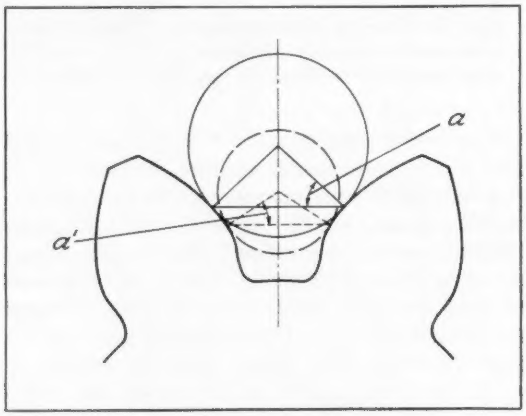


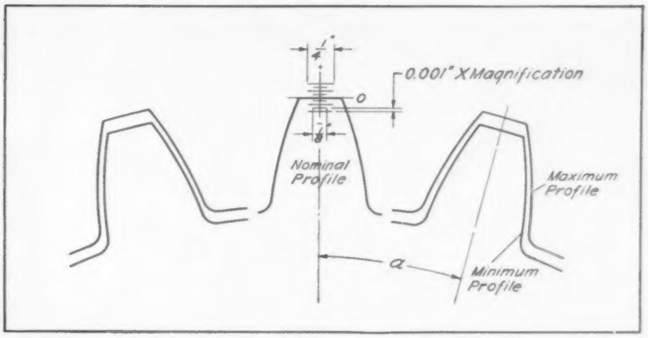
Fig. 2. Measurements are affected by the contact angle of the pin with the tooth profile. Here, angle (a) is more favorable than angle (a').

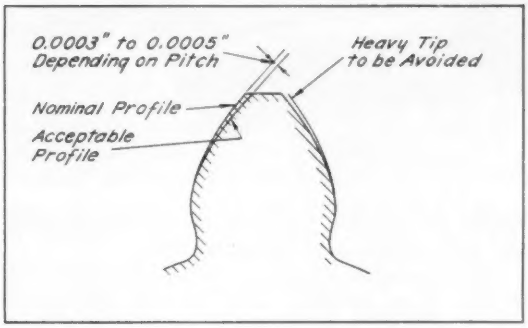
The nylon test gears were mounted under the gaging spindle of the device in a suitable holder. Accurate means of recording the surrounding temperature and relative humidity were provided. Spur and helical gears of several sizes, pitches, and pressure angles were tested under various combinations of temperature and relative humidity.

The investigation disclosed: first, that measurements over pins are unreliable when tolerances are less than plus 0.002 inch, minus 0.002 inch; and second, that measurements are affected

Fig. 3. (Right) Lay-out chart for an optical comparator gear check. When a tooth is centered on the chart, adjacent teeth must fall within double profile lines.

Fig. 4. (Below) Reasonable variation in involute form should tend to increase the pressure angle and thin the tip.





in varying degrees by temperature, relative humidity, checking pressure applied, pin size, pin position on tooth profile, gear type (spur or helical), helix angle, and pressure angle.

The first three factors—temperature, relative humidity, and checking pressure applied—are of prime importance, although the influence of relative humidity is less on gears stabilized by stress relieving following the molding operation. The importance of the factor of pin size is illustrated in Fig. 2. Pins of different diameter have a different angle of contact with the gear teeth.

A further disadvantage of pin measurements is that they fail to indicate run-out, profile error, and variations in tooth thickness. While a close correlation exists between pin measurements and functional checks of precision-cut metal gears, this seldom is true in the case of injection-molded nylon gears.

Certain users of injection-molded nylon gears check tooth profile by projection methods. While cut-metal gears produced individually lend themselves ideally to this method of quality control, they pose a problem when molded as a cluster. The pinion of the cluster must be checked by reflected illumination (episcopic projection), but nylon does not have a good reflective property. What is more, the surface toward the objective lens of the comparator is not sharp and well defined, as is true for a cut gear, since molding tends to round off the teeth edges. As a result, the image projected on the screen is not the actual tooth profile. Another drawback to the projection of nylon gears is that the translucency of the material creates a halo on the screen, especially with very thin gears. This halo can be reduced, however, by tinting the gears during stress relieving.

Frequently, the customer furnishes the molding company with a tooth form chart or a drawing of a basic rack. This information defines the theoretically perfect tooth form, but it is little use to the molder, since no working tolerances are given. Obviously, all pieces cannot be perfect, so while a nominal outline of a tooth form can serve as a tooling guide, it is unsuitable for quality control.

A lay-out chart for checking gears on optical comparators, Fig. 3, is used widely, and approved by optical gaging equipment manufacturers. An outline of three teeth appears on the chart, with the center tooth made to nominal dimensions and having a scale for adjusting size in a plus or minus direction. The end teeth are made with double lines representing maximum and minimum conditions of tooth profiles. Angle a, the distance from one tooth to the next, has no tolerance, and represents the nominal angular distance.

To pass inspection, a gear must fall within the double lines of the end teeth on the chart when the middle tooth is centralized and adjusted for size. The outline of the gear being inspected may be at the extreme right or left of either adjacent tooth, or anywhere between the double profile lines.

A projection inspection with such a lay-out considers the several kinds of errors that are disclosed in a composite check in the tolerance band by means of a master gear on a variable center distance fixture. These errors include run-out, tooth thickness variation, pitch error, and profile error.

Designers who substitute small nylon gears for metal gears are prone to overemphasize the importance of tooth form. Where a special form has been developed, there is often a reluctance to modify it in any way in order to let the molder

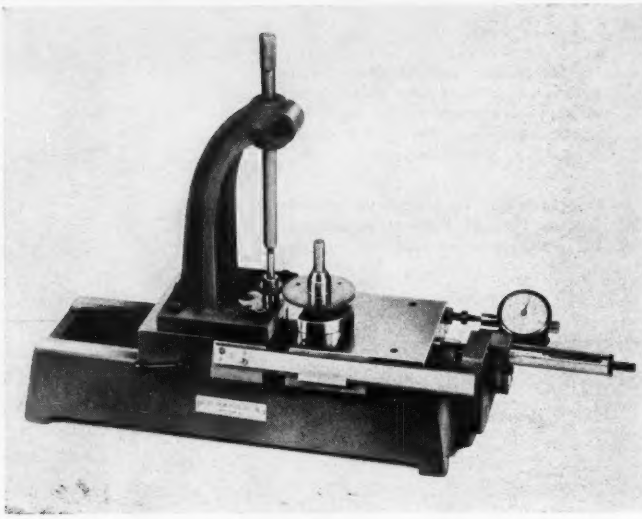


Fig. 5. This variable center distance fixture checks the gear against a master. Checking pressure is adjustable for the required degree of sensitivity.

make the part economically. Frequently, impractical limits or no limits at all are given.

It should be pointed out that a reasonable variation in involute tooth form can be tolerated with a resilient material like nylon. As was explained in "The ABC's of Designing Injection-Molded Nylon Gears," published in November, 1955, MACHINERY, a change in the pressure angle or tooth profile can be tolerated so long as a corresponding change is made in the mating member. Conjugate action will be obtained if the change is of the same magnitude. Any design modification to be made, however, should be such that the tip is thinned and the pressure angle is increased. (See Fig. 4.) A low pressure angle should be avoided, for it produces interference and unfavorable load concentrations.

The composite check, or functional check, as it has more recently been termed, antedates other gear checking methods. Long before pin measurement systems were devised or optical comparators invented, gears were checked by rolling one with another and manually sensing the tooth action. From hit-or-miss methods with crude instruments having fixed centers, the composite check has evolved into an extremely reliable means of quality control. Variable center distance fixtures now available are equipped with sensitive slides, indicating devices, and checking-pressure controls. A number of them

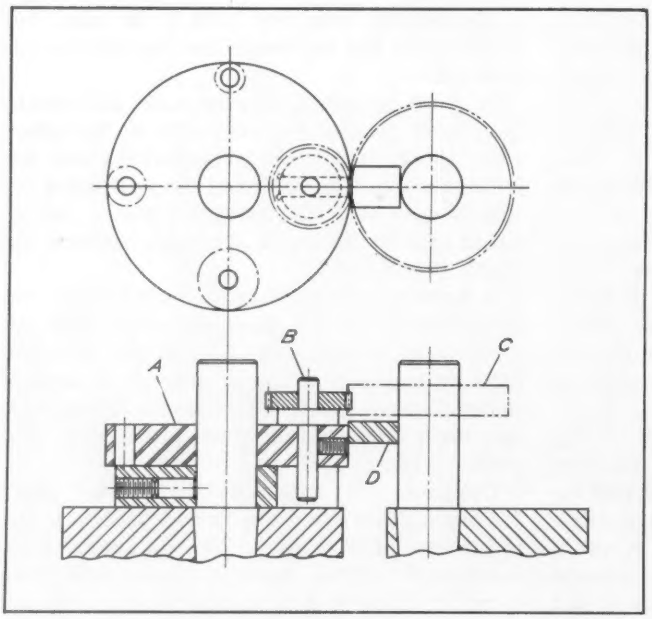


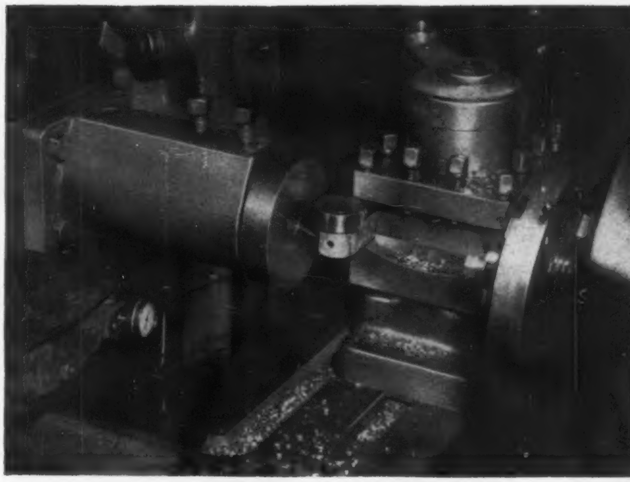
Fig. 6. With this indexing workholder, gears of different diameter can be rapidly and accurately inspected on a variable center distance fixture.

can be obtained with charting mechanisms that graphically record radial displacement. Master gears used in conjunction with the equipment have up to 200 diametral pitch, and a total composite error variation of only a few ten-thousandths inch.

Quality control of gears turned out in large lots assumes a random error distribution. Very few gears are given a complete check. Production rates for injection-molded nylon gears vary from 500 to 3000 pieces per hour, depending on the gear size and the number of cavities in the mold. Thus, molding cost per gear is comparatively low, and the cost of controlling its quality must necessarily be in line. Elaborate quality control involving projection equipment, except as an occasional spot check, is impractical because of its high cost and slowness.

Quick and accurate checks against a master gear can be made with the simple variable center distance fixture illustrated in Fig. 5. This fixture has an adjustable checking pressure control so that any required degree of sensitivity can be obtained. Where gears of different diameter are to be checked rapidly, the fixture can be adapted with the indexing work-holder shown in Fig. 6. Turret plate *A* has a series of holes containing work-holding pins *B*. Each hole is a specified distance from the plate center, and when indexed and locked in alignment with master gear *C*, pitch radius setting is established automatically. Gage-block *D* placed between the turret periphery and the master gear shaft establishes center distance.

Quality control of injection-molded nylon gears should follow accepted standards for other items produced in large quantities. Quality must surely be safeguarded. Of equal importance is the realization of cost objectives through good common sense and realism.



Cam-Disc Controls Angular Cutting of Turret Lathe Attachment

An ingenious turret lathe attachment which permits angular cutting on the face of a bilge pump impeller has increased production 50 per cent while virtually eliminating scrap. As illustrated in Fig. 1, a roller, mounted parallel to a cutting tool on an unlocked cross-slide, follows a concave cam profile on a disc locked in the turret. By allowing the cross-slide movement, the proper cutting angle is determined by the pressure of the roller as it travels across the face of the cam-disc.

The pump impeller, shown in Fig. 2, is made from a phosphor-bronze casting and is machined to a tolerance of 0.0015 inch with a 6-degree angle on the face. In the former method of facing, a sciving tool was employed. The pump is used in the Army's water-going M-59 armored personnel carrier, produced by the Ordnance Division of Food Machinery & Chemical Corporation, San Jose, Calif., where this method was devised.

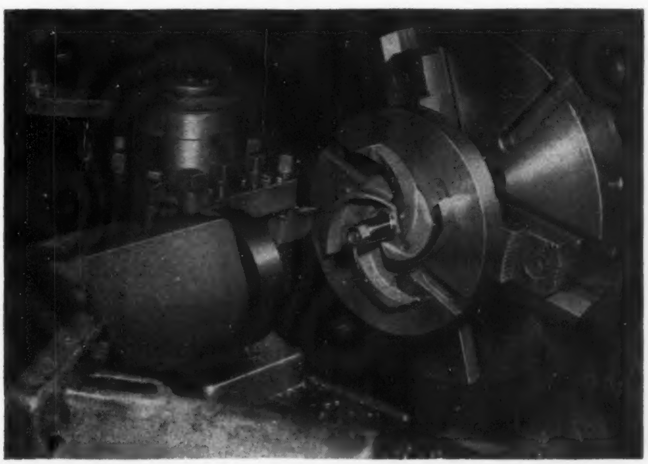
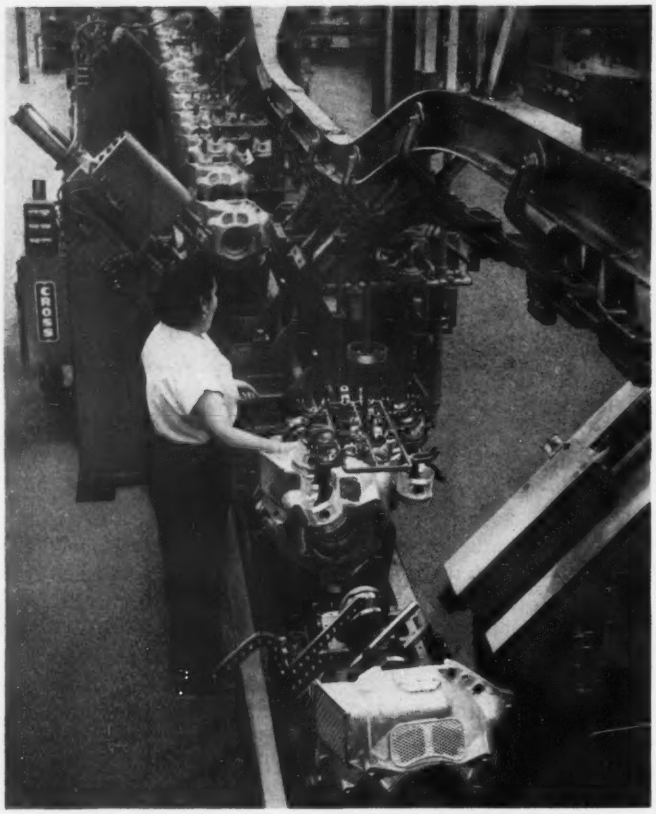


Fig. 1. (Above) Because the cross-slide is allowed to move, the cutting tool is guided by the pressure of roller following the profile of concave cam-disc

Fig. 2. (Left) Cutting tool has finished machining a 6-degree angle on face of pump impeller used in bilge pump for the water-going M-59 armored personnel carrier

Automatic Engine Assembly



Final assembly of Plymouth V-8 engines is accomplished on a Cross transfer machine 560 feet long. Intermittent movement of the assemblies along the line permits use of automatic nut-running machine units, resulting in closely controlled torque application and uniform high-quality engines

By CHARLES H. WICK
Associate Editor

A MAJOR step in Chrysler Corporation's continuing expansion of automobile production facilities is a Plymouth V-8 engine plant equipped with the most advanced manufacturing equipment and automation devices. This modern facility has been nicknamed the "Qualimatic" plant because quality control of production is maintained through automatic processing. Planned output at present is 2400 engines per day.

One important innovation is a unique method of assembling engines on a Cross Transfer-matic that has an over-all length of 560 feet and contains 140 stations. The V-8 engine assemblies, each carried on an individual pallet, are automatically transferred 48 inches to successive stations after a dwell of sixteen seconds required to perform the necessary manual or automatic assembly operations. Transfer from station to station takes eight seconds, resulting in a completely assembled engine at the end of the line every twenty-four seconds.

In this set-up, automation has been effectively combined with manpower to insure rapid, high-quality production. The accurately controlled, intermittent transfer of the engine assemblies from station to station along the line permits the use of automatic, air-operated machine units for nut-running and other functions. Since the nut-runners and operators do not have to travel with the engines, as in conventional conveyor lines, efficient assembly is facilitated. The amount of torque applied in tightening the nuts, screws, bolts, and studs is accurately controlled. Maintenance and down time are minimized. All of the machine units have identical standardized bases, so that their positions along the assembly line can be transposed to accommodate changes in engine design.

Because of expansion and contraction of the transfer bar, and the fact that indexing type pallets are only required along the first portion of the final assembly line, the transfer machine is divided into three parallel sections, the second and third sections being offset and slightly overlapping the preceding sections. The first section

on a Transfer Machine

contains 47 stations; the second, 44 stations; and the third, 49 stations.

Pallets for carrying the partially assembled engines along the lines are of the cradle type. They are mounted on a continuous chain and roll along ways provided for each section of the transfer machine. There are 96 pallets on the chain for the first section, 90 on the second, and 100 on the third. When the engines are automatically transferred at the end of each section, the empty pallets return beneath the floor to the loading end of each section. Movement of the pallets from station to station is accomplished hydraulically by means of pusher dogs and transfer bars. Accurate location of the work-pieces is obtained at each station by pins rising from below and entering locating holes in the pallets.

The loading end of the first section is seen in Fig. 1. Here, completely machined cylinder blocks, to which the bearing caps, welch plugs, clutch housing, and dowels have been assembled, are received by means of automatic handling devices from the cast-iron machining area. The bore sizes in each cylinder block are teletyped to the piston and rod assembly department to facilitate selective assembly of these parts.

Then, the blocks are automatically loaded on the pallets with their pan faces up and front ends leading, locating from four previously machined pads on each block. Also, a locating plug on each pallet enters the distributor shaft hole in the block. Clamping of the block to the pallet is not required. A counterweighted tray is provided on each pallet to hold the main bearing caps when they are removed.

The second station on the first section of the transfer machine is idle. When a block has been transferred to the third station, the ten bearing cap screws are automatically loosened. This is accomplished by one vertically mounted, ten-spindle machine unit. This machine head, as well as all the other tightening units on the Transfermatic, are fed by double-acting compressed air cylinders, and equipped with Thor air-operated nut-setters. The tools operate from a multiple manifold. As the heads are fed downward, they trip limit switches which actuate solenoids to start the tool operation.

An idle station is provided after this and all other stations having automatic machine units. This is done to permit manual operation in case of machine breakdown or maintenance, thus avoiding interruption of production. Portable tools are suspended overhead at these idle stations to perform the necessary operations.

At the fifth station, the loosened main bearing caps and screws are manually removed and placed in the tray on the pallet. The next station is used to blow off the main bearings and blocks. Seals, valves, bearings, screws, washers, caps, spacers, thrust plates, timing chain, housings, eccentrics, gaskets, covers, pulleys, and dust pans are among the parts manually positioned in or on the blocks at subsequent stations along the first section.

Such miscellaneous small engine parts are delivered to the assembly transfer machine in trays suspended from an overhead chain conveyor to eliminate storage along the line. The trays, made from plastic and color coded, have individual containers for each type part. Coloring of the trays simplifies identification, permitting the operator to readily select the required part from the proper tray. The tray compartments are automatically loaded with the exact number of parts needed by means of Syntron vibratory hoppers located in a separate receiving area of the plant. As shown in Fig. 2, the trays travel on an inter-

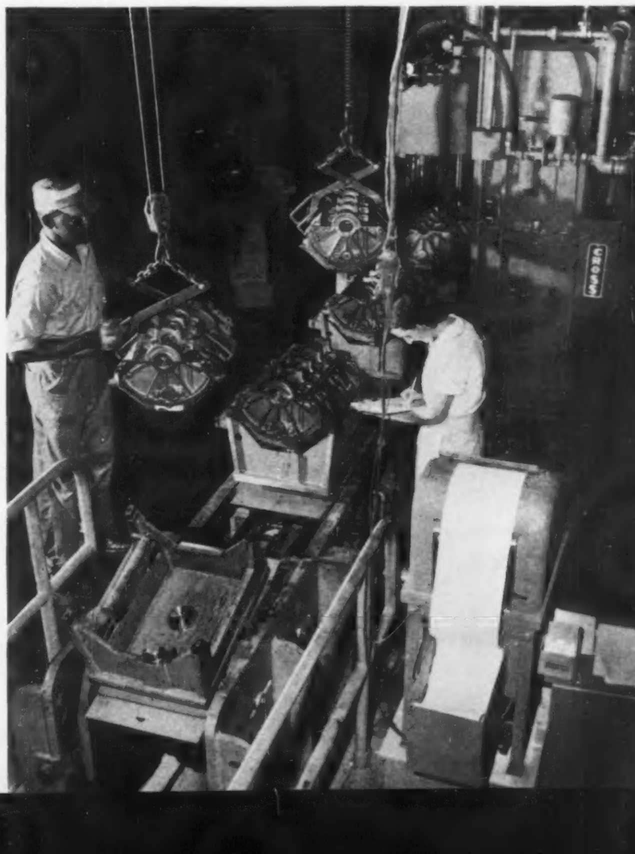


Fig. 1. Loading end of final assembly transfer machine. Pallets for carrying the engines are mounted on a continuous transfer bar type conveyor line.

mittent-moving belt conveyor and are filled from individual hoppers containing the various parts.

The various screws (bearing cap, camshaft sprocket thrust plate, and chain case cover) which have been started by hand to avoid damaging the threads, are automatically tightened by multiple-spindle machine units equipped with air-operated setters. For example, the ten screws for holding the five main bearing caps are all tightened simultaneously by one ten-spindle unit at Station 17. In Fig. 3 is shown the set-up at the thirtieth station. Here, a single-spindle unit seen at the lower right is used to tighten the camshaft eccentric screw. The unit at the upper left holds the crankshaft in the required location during tightening.

Torque applied to the screws in tightening is accurately controlled—within plus or minus 5 foot-pounds on critical elements—by means of individual orifices for each spindle. Also, a Ross release valve shuts off the air supply to each spindle after the screw has been tightened to the required torque, thus preventing the socket from binding.

At another station in the first section of the transfer machine, the main and camshaft bear-

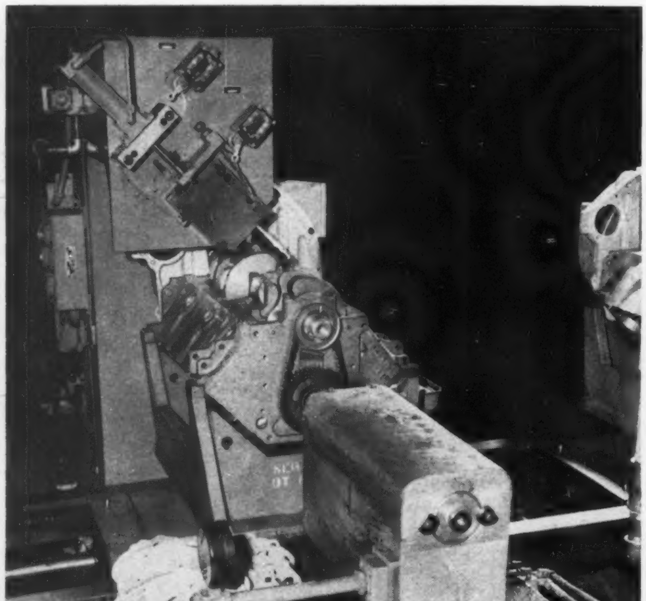


Fig. 2. (Above) Trays for carrying small engine parts to assembly machine are loaded from vibratory hoppers as the trays move on a belt conveyor.

Fig. 3. (Left) At Station 30 of the first section, an air-operated setter tightens the camshaft eccentric screw while the crankshaft is held in required position.

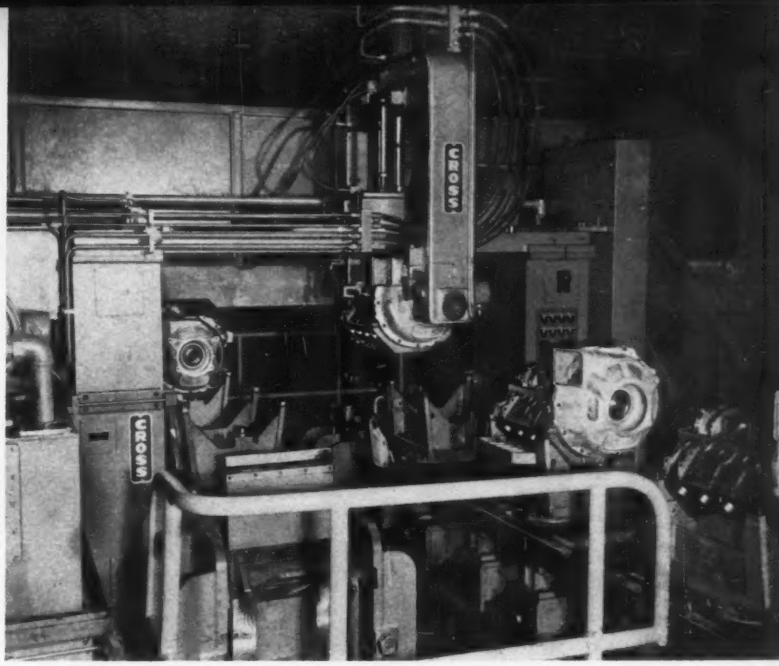


Fig. 4. (Right) Hydraulically operated unit for automatically transferring partially assembled engines from unloading end of first section to starting position of second section

Fig. 5. (Below) Air-operated nut-runners on this multiple-spindle machine unit at Station 37 tighten sixteen of the eighteen oil-pan attaching screws.

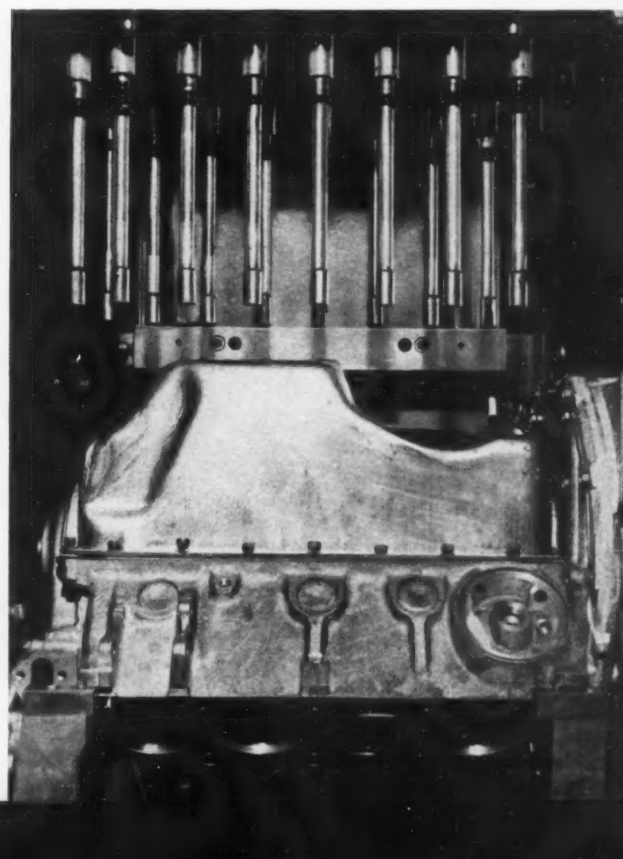
ings are automatically sprayed with oil. Also, at two other stations the partial engine assemblies are indexed to positions with the clutch housing to the right and then with the front end leading, by automatically pivoting the work-holding pallets 90 degrees in a horizontal plane.

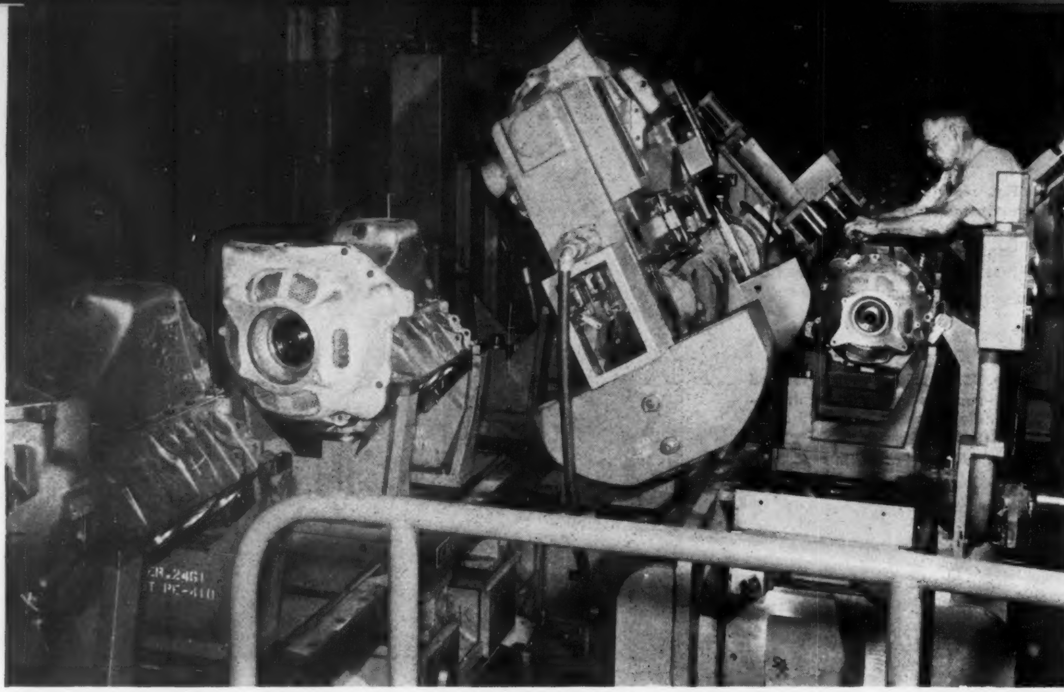
Transfer of the engines from the end of the first section to the beginning of the parallel second section is performed automatically by means of the hydraulically operated unit seen in Fig. 4. This unit lifts an engine from a pallet at Station 47 of the first section (right), carries it to the left, and lowers it onto a pallet at the first station of the second section (left). The blocks are again located from the four machined pads, and a locating plug on each pallet enters the distributor hole in the block. The pallets in Section 2 do not pivot since there is no further need for indexing.

Manual operations performed in the second section of the transfer machine include inserting bore protectors and assembling the pistons and rods. Since the crankshaft must be rotated to a different position before assembling each piston and rod at the uppermost position, these operations require eight stations. Pistons supplied coincide with the bore sizes teletyped from the beginning of the assembly line. Connecting-rod caps and nuts are assembled at four more stations in sets of two. Other manual operations performed include assembly of the oil-pump, suction pipe, gaskets, strainer, oil-pan, and attaching screws.

Automatic operations done as the engine assemblies move intermittently along the second section are swabbing of the bores, positioning of the crankshaft, tightening of the connecting-rod cap nuts, and tightening of the oil-pump and oil-pan attaching screws. The cap nuts are secured at four different stations. Sixteen of the eighteen oil-pan attaching screws are tightened simultaneously by the multiple-spindle head, Fig. 5.

Transfer of the engines from the end of the second section to the beginning of the parallel third section is also performed automatically by the hydraulically operated roll-over fixture seen in Fig. 6. The fixture lifts an engine from a pallet at Station 44 of the second section (left),





rolls it over 180 degrees in a vertical plane, and deposits it, pan face down, front end leading on a pallet at the first station of the third section (right). In this instance, a construction hole in the pan rail surface of the engine block, previously used during machining, is employed for locating purposes.

Engine parts manually assembled and automatically secured in the third section of the transfer machine include the cylinder heads and intake manifold. The right- and left-hand V-8 engine heads are sub-assembled, including valve trains, exhaust manifolds, and rocker arms, on two separate Cross Transfer-matics, each 126 feet long and containing 29 stations. The head sub-assemblies are transferred to the main assembly line for manual installation on the engine blocks.

The angular, multiple-spindle heads provided at Station 15 for automatically tightening the cylinder head bolts are shown in Fig. 7. Because of the close spacing of the intake manifold

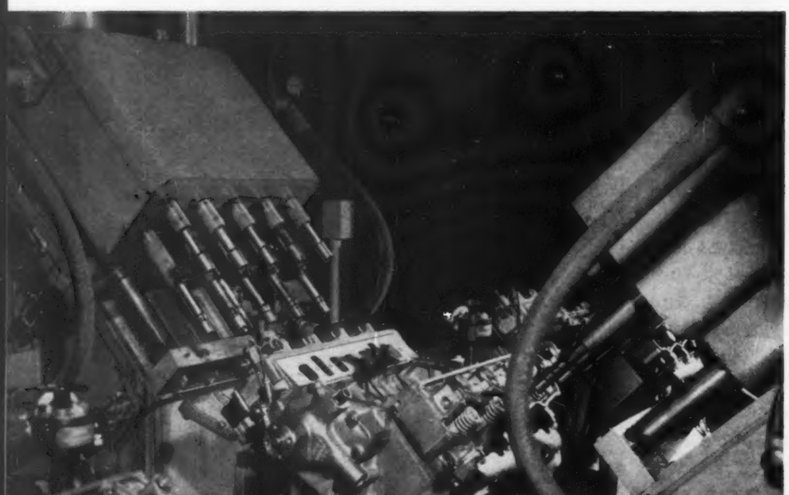


Fig. 6. (Above) Engines are swung vertically through 180 degrees and placed pan face down, front end leading, by means of this hydraulic roll-over fixture.

Fig. 7. (Left) Bolts for securing cylinder heads to the V-8 engine blocks are automatically tightened by angularly mounted, multiple-spindle heads.

screws and bolts, they are automatically tightened at three separate stations, as seen in Fig. 8. Another automatic operation performed in the third section is the squirting of oil in the cylinder bores to provide initial lubrication. Alignment of the teeth on the drive-shaft gear with those on the camshaft gear, timing, and positioning of the crankshaft for checking and setting of the tappets, are all performed manually at this time. A main console for all three sections of the final assembly transfer machine contains signal lights which indicate satisfactory operation or pin-point stations where trouble is being encountered.

At Station 49 of the third section, the engines are transferred to a paint conveyor. Masks are assembled to the intake manifold carburetor opening, spark plug openings, distributor, clutch housing, torque converter housing, oil filter opening, water outlet, fuel pump opening, and fan drive pulley. Automatic painting of the assembled engines is performed electrostatically in a 150,000-volt system, with the paint being attracted to the grounded engines as they pass

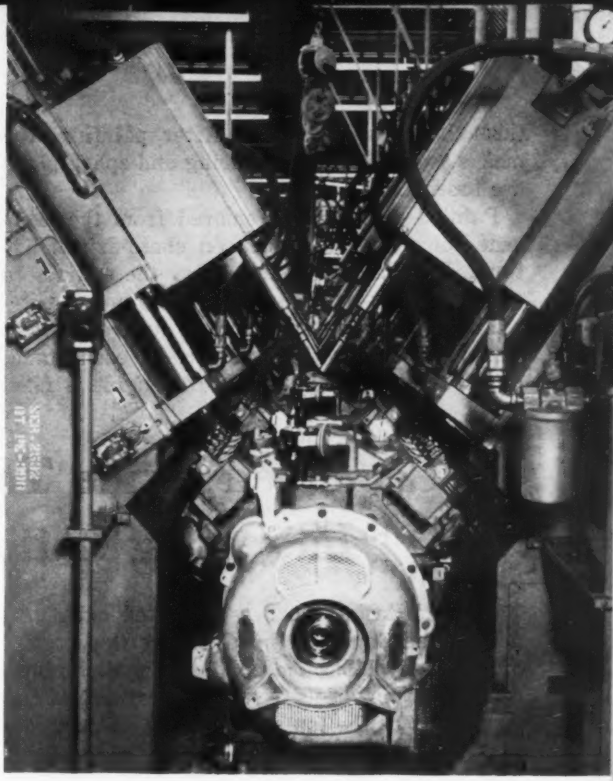


Fig. 8. (Above) Screws and bolts for securing intake manifold to engine assembly are automatically tightened on this battery of air-operated units.

Fig. 9. (Right) Part of the seventy-two stands employed for twenty-minute operational tests of assembled engines. The test stands are automatically loaded and unloaded.

through the spray booth. After painting, the masks are removed, and wiring and spark plugs are assembled.

Painted engines are removed from the overhead conveyor and loaded on chain-driven fixtures, Fig. 9. The fixtures carry the engines to one of seventy-two Nankervis test stands—automatically loading each engine into an empty stand, by-passing those in use. In each stand, a test carburetor is applied; the engine is filled with oil and water; and fuel and exhaust attachments are made—all automatically. Natural gas is used as fuel to reduce costs, lessen fire hazards, and minimize exhaust problems. During a twenty-minute operation of each engine, tests are made to detect oil or water leaks, and oil pressure is checked. Signal lamps indicate test results. Satisfactory engines are removed from the fixture and conveyed to a storage area for shipment to automotive assembly plants.

Cemented Oxide Tools Show Promise of Increasing Cutting Speed Ranges

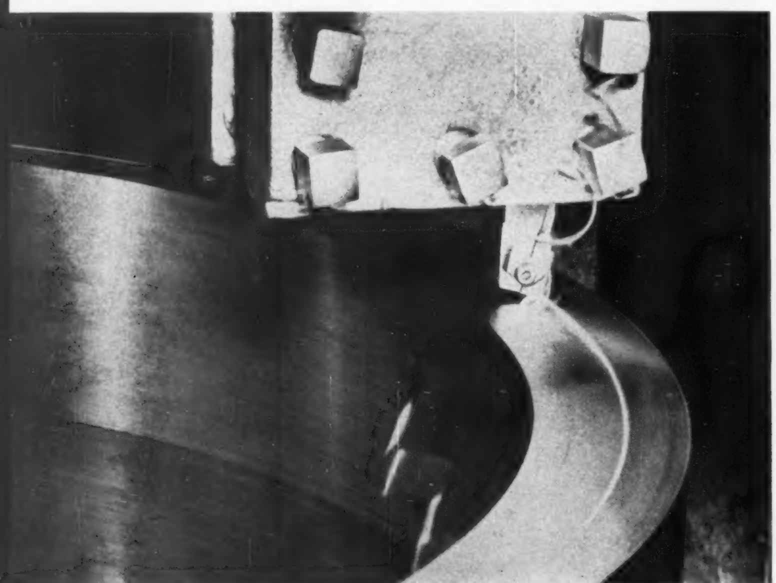
INITIAL tests of a new cemented oxide tool material developed by Carboloy Department of the General Electric Co., Detroit, Mich., indicate that it may be used successfully for finishing operations at the top speed ranges of machines currently in use. Performance of the material, however, is considerably improved at cutting speeds of 1000 surface feet per minute and over.

Several attempts were made in the past by the company to develop a material of the ceramic family specifically for cutting tools. The new material, under development since 1951, was the first composition to emerge having properties warranting appraisal. It should be available to users on a limited basis by January 1. Because the cemented oxide is processed by powder metallurgy techniques and is made of materials that are in abundant supply, it should be ultimately obtainable in the usual variety of shapes.

Although no coolant is required with this material, it may be used if heat deformation of the work is a factor. The tool material does not heat up; it is generally cool to the touch following a machining operation. Most of the heat generated during cutting is transferred to the chip, while some is absorbed by the work.

Inserted tips of the material, which are currently used with mechanical holders, will not only machine materials such as AISI 1045 and softer steels, but also Type 4340 and similar steels having Brinell hardnesses up to 300. Results of wear tests run on cemented oxide indicate that an exceptionally long tool life can be realized. For finishing cuts, the material is expected to reduce cutting time drastically.

Limited information now on hand reveals that



A 1 5/16-inch length of cut is shown being taken across the face of a retaining ring by a cemented oxide cutting tool at a speed of approximately 450 surface feet per minute. Resultant tool wear is barely noticeable.

tool tips of cemented oxide can be wet-ground successfully with 220-grit diamond wheels. Use of finer-grit diamond wheels is possible, but longer grinding time is required. Silicon carbide wheels have been used, but for rough-grinding only. A honed area around the cutting edge and nose radius of the tool tip is necessary. At present, tool geometries of 5 to 10 degrees negative back and side rake, relief angles of about 10 degrees, side cutting edge angles of up to 60 degrees, and nose radii of 1/16 inch seem to be the most successful.

Cemented oxide presents the same difficulty of classification in conventional material categories as did cemented carbides when they were first introduced. The material has a two-phase structure. It has a transverse rupture strength ranging from 80,000 to 100,000 pounds per square inch, a density ranging from 4.1 to 4.2, and a hardness of 93 to 94 Rockwell A. The material offers good resistance to oxidation, and is generally resistant to corrosion.

In a test, a 37-inch diameter turbine retaining ring made of nickel-chromium-molybdenum steel, heat-treated to a Brinell hardness ranging from 270 to 295, was machined on a King boring mill. A cemented oxide cutting tool was used to turn the periphery of the work and to take a facing cut, both with and without coolant. With the machine running at a speed of 485 surface feet per minute, and using a water-soluble coolant, a cemented oxide tool was employed to turn the periphery of the retaining ring for a distance of 9 1/2 inches, with a depth of cut of 0.020 inch and a feed rate of 0.010 inch per revolution. After seventeen minutes of cutting, the tool showed a wear land of only 0.002 inch. Under dry conditions, a 3 1/8-inch wide cut was made on the outer surface of the work. Wear on the cemented oxide was hardly noticeable.

While taking a facing cut on the retaining ring, which is shown in the accompanying illustration, the tool was again run dry. As it was fed toward the center of the work, taking a 1 5/16-inch length of cut, machining speed varied from 415 to 485 surface feet per minute. The tool was set for a 0.0625-inch depth of cut and a feed rate of 0.011 inch per revolution. After completion of this operation, wear on the cemented oxide tool was barely discernible.

When the machine speed was reduced to 230 surface feet per minute, the cemented oxide material still continued to remove metal without chipping, but seemed to push the metal off rather than part it with a shearing action. This might have been due to the tool angles used rather than to the cutting material itself.

An indication of the wear life of cemented oxide cutting tools can be gained from the results of another test. This consisted of turning a 1045 steel motor shaft, ranging in hardness from 170 to 210 Brinell, to a diameter of 5 3/4 inches. The work was run dry at a speed of 900 surface feet per minute, with a depth of cut of 0.100 inch and a feed rate set at 0.005 inch per revolution. With this new material, a cut 111 inches long was made in thirty-six and one-half minutes.

During laboratory tests on Type 1045 steel, finishing cuts were taken at speeds ranging from 1800 to 2000 surface feet per minute. A tool life of about twenty-five minutes was obtained at a speed of 2000 surface feet per minute with a depth of cut of 0.010 inch and a feed rate of 0.005 inch per revolution.

* * *

Consumable-Electrode Vacuum Melting of Superalloys

Production facilities for high-alloy steels have been expanded with the opening of a new melting department recently announced by Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. A feature of the department, located in the Watervliet, N. Y., plant, is the new consumable-electrode vacuum melting furnaces for producing superalloys required for jet engines, tool steels, and high quality stainless steels. Capacity is 250,000 pounds per month, but the department can be rapidly expanded to four times its present size.

Consumable-electrode melting of metals under vacuum has been used commercially for years in melting materials such as titanium, zirconium, and molybdenum. However, modifications in the process had to be made in applying this principle to superalloys. The procedure consists of making cast electrodes of an alloyed, predetermined composition from a large, production-size, electric furnace air melt, and then remelting these electrodes under vacuum by arc melting in a water-cooled copper crucible. Ingots up to 16 inches in diameter and weighing 2000 pounds have been made, and ingots weighing up to 4000 pounds are planned.

The appreciable quantities of titanium and aluminum in nickel- and iron-base superalloys posed many production problems with regard to cleanliness and workability when they were made by conventional melting practices in air. Test results on finished products made from consumable-electrode, vacuum-melted ingots show a high degree of cleanliness attained through removal of non-metallic inclusions and excess gases; better compositional homogeneity through freedom from segregation; improved workability and ingot soundness resulting in increased yields; and improvements in mechanical properties.

Selection, Care, and Installation of Anti-Friction Bearings

Various types of ball and roller bearings, as well as their applications and advantages, were described in the first installment of this article, published in the November number of MACHINERY. This concluding installment will discuss the sealing, care, and installation of ball and roller bearings

By E. P. STAHL
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BALL and roller bearings are rather rugged devices, but they have to be handled and installed with reasonable care if optimum service is to be secured. They also have to be protected with good seals and lubricants. Since dirt is considered the No. 1 enemy of ball and roller bearings, it is important that it be excluded. Practically all dust and dirt are abrasive and cause wear, and they will reduce the accuracy and shorten the life of bearings. No matter how well a bearing is made and lubricated, it will not give a full measure of service unless it is protected by good seals.

It is not always the obvious kind of dust and dirt that is detrimental to bearings. In every factory, even though clean to the eye, there is dust present. Such dust will settle into lubricants, exposed machine parts, and bearings, if they are not thoroughly protected or masked.

During assembly, bearings may be exposed to some contamination. If this occurs, their service life is materially shortened. Also, if bearings are left exposed on the assembly bench or floor for any length of time they should be covered or masked. They should be left in their original cartons or wrappings until ready for use.

Substances that are most likely to impair proper bearing action can be divided into three general classes:

Abrasives—In this category are substances of sufficient hardness to cut balls, rollers, and raceways, thus causing the bearing surfaces to be roughened and the bearing clearances altered.

Foreign particles—Included in this category are core sand; and chips of brass, iron, steel, or other metals. They do not usually cut the balls, rollers, and raceways, but they can impede bearing operation and destroy its action.

Corrosive agents—In this category are water, acid, fumes, and alkalies. When in direct contact with the finely finished surfaces of bearings, these substances can quickly reduce the efficiency of bearings by etching action.

Various Forms of Seals or Closures

To guard against the ingress of extraneous materials and to retain lubricant in the bearings, various forms of seals or closures are used. Some of the most common forms of seals are shown in Fig. 20. Designs *A*, *B*, and *C* show mechanical clearance seals. These types are really not true

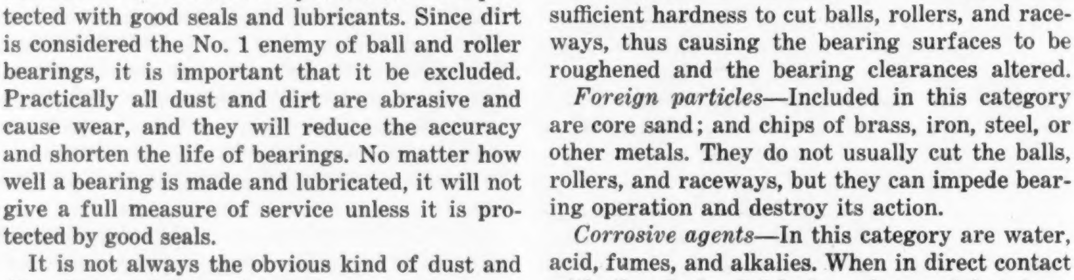


Fig. 20. Common forms of bearing seals include mechanical clearance types (Designs A, B, and C), felt types (Designs D and E), and unit types (Designs F and G).

seals, and they depend upon lubricant between the stationary and the rotating members to do the sealing. Such mechanical clearance type seals are used, however, because they are relatively inexpensive, and are practically frictionless and indestructible. The sealing efficiency of such seals at low and moderate speeds varies from poor to good when the bearings which they protect are lubricated with solid or semi-solid lubricants. They will not hold oil under pressure and are not very effective where dirt and moisture are present in the seal area. They operate best where hard, smooth shafts are used.

Designs *D* and *E* are felt seals with which the relative sealing efficiency varies from fair to good. Felt seals are used for both oil and grease retention at low and moderate speeds, but they will not hold oil under pressure. They are not very effective where dirt and moisture are present in the seal area, and they are apt to pick up grit or dirt and cut the shaft. Felt seals also operate best on hard, smooth shafts.

Designs *F* and *G* are unit or lip type, synthetic rubber and leather seals, respectively, with metal shells or cases. These seals, on account of their integrated construction, high sealing efficiency, and relatively low cost, are popular for automotive, tractor, and general industrial applications. They have a relatively high sealing efficiency at low, moderate, and high speeds, and seal against either oil or grease. However, they will wear rapidly if allowed to operate dry. Unit seals, like all rubbing or contact type seals, must operate on a hard, smooth shaft surface for efficient operation, and also need some lubricant in the seal area. They are held in intimate contact with the shaft with either a finger or garter type spring. Unit seals are designed to be press-fitted into a machined recess or housing bore, and are available in both spring-loaded and non-spring-loaded types.

No one particular type of seal or closure can be equally effective for all bearing applications and operating conditions. For instance, dust and grit may be excluded from a bearing by a seal that is ineffective against water. Each seal, like the bearing it protects, should be studied from the standpoint of the operational and environmental conditions, and the selection made on the basis of specific service demands.

The addition of a slinger or shroud to a shaft or bearing housing, as shown in Figs. 21 and 22, improves the efficiency of the primary seal, particularly where difficult sealing conditions prevail. Even though lubrication of anti-friction bearings is often given the highest priority by bearing engineers, seals and sealing run a close second. It is false economy to lubricate high-grade anti-friction bearings with quality lubricants and try to protect them with poor seals. Bearings, seals, and lubricants are more or less interdependent in modern machine designs and their selection deserves well informed and considered decisions.

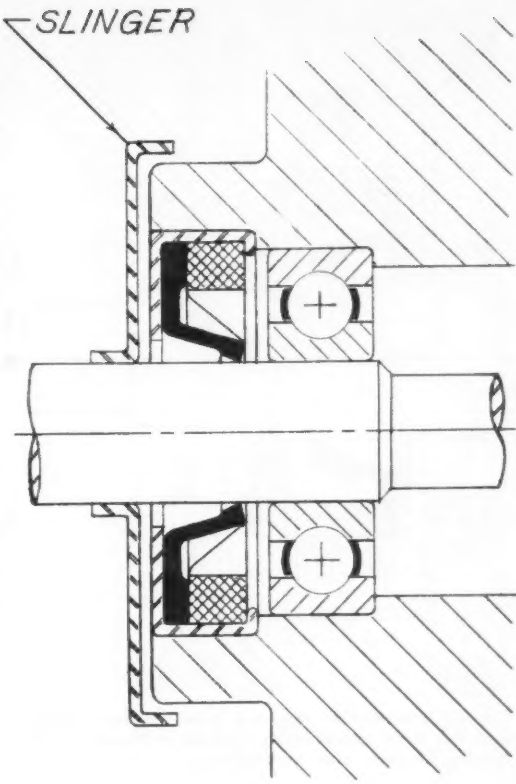


Fig. 21. Slinger, mounted on shaft, improves the efficiency of unit type, synthetic rubber seal on this single-row, radial ball bearing

Sealed Bearings Reduce Maintenance

No article on anti-friction bearings would be complete without mention of sealed or so-called "self-sealed" bearings. Sealed ball and roller bearings have found a useful place in the anti-friction bearing family for applications in electric motors, automobiles, tractors, aircraft, and textile machinery. Since they combine the bearings, seals, and lubricant in a single unit, sealed bearings are particularly desirable for use in out-of-the-way places where lubrication is apt to be overlooked or carelessly done.

When single-row ball bearings were first developed, no thought was given to integral seals, as little space was available on either side of the bearing for the incorporation of seals. Engineers have solved this problem by the development of thin, synthetic rubber seals or inserts which can

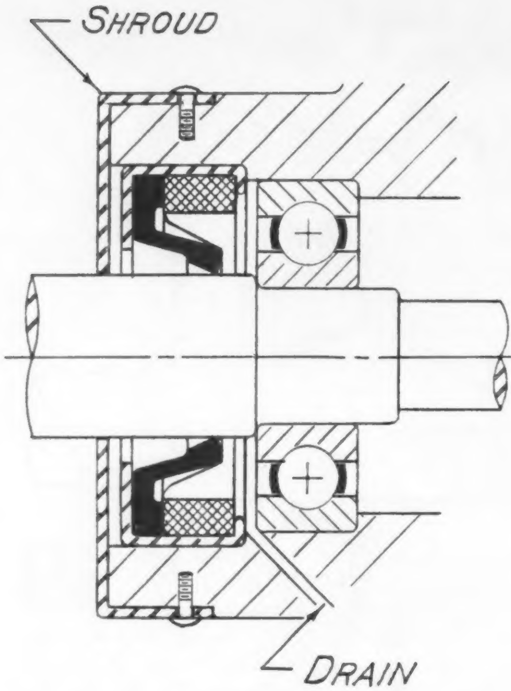


Fig. 22. Efficiency of this unit type, synthetic rubber seal has been improved by securing a shroud to the housing. Angular hole in housing provides drain-back

be incorporated in the restricted space in any standard ball bearing. An example of such a seal is illustrated in Fig. 23, Design *B*, showing thin seals made of synthetic rubber bonded to metal discs or stiffener rings. These seals are designed to snap into an annular groove in the outer bearing ring and to contact another groove in the inner bearing ring.

Design *A* is a sealed, single-row ball bearing having a double-row width to provide generous lubrication space on both sides of the bearing. This bearing is also self-contained, non-separable, and suitable for combination radial and thrust loads. The bearing is equipped with double metal, removable seals of flanged construction, that are available with or without external snap-rings.

Design *C* is a single-row sealed ball bearing with built-in synthetic rubber seals. Experience in the field with bearings equipped with this type seal shows that they are practically leak-proof. Also, they run cool, seal efficiently, and have a long life. The design of bearings with such seals provides sufficient space to accommodate, without crowding, the required amount of grease that is packed into each bearing at the time of manufacture.

A recent development in sealed bearings is illustrated at *D*. This is a thin-section, cageless needle bearing with built-in, synthetic rubber, unit type seals. The seals are located securely in the outer race bore with a heavy press fit. These bearings are made with the seals facing either inward toward the rollers or outward. The simplicity of design is obvious, and unlike the sealed bearings previously described, this bearing has provision for re-lubrication through the outer or inner race.

Shown at *E* is a recently developed single-row, spherical, self-aligning roller bearing with built-in synthetic rubber seals. This bearing offers high, radial-load carrying capacity in a restricted space along with the self-aligning feature. Design *F* shows a sealed, double-row, self-aligning roller bearing with concave rollers and convex raceways. This bearing, like the single-row spherical roller bearing previously described, is suitable for airplane controls and similar applications where a high-capacity, self-aligning bearing is needed in a constricted space.

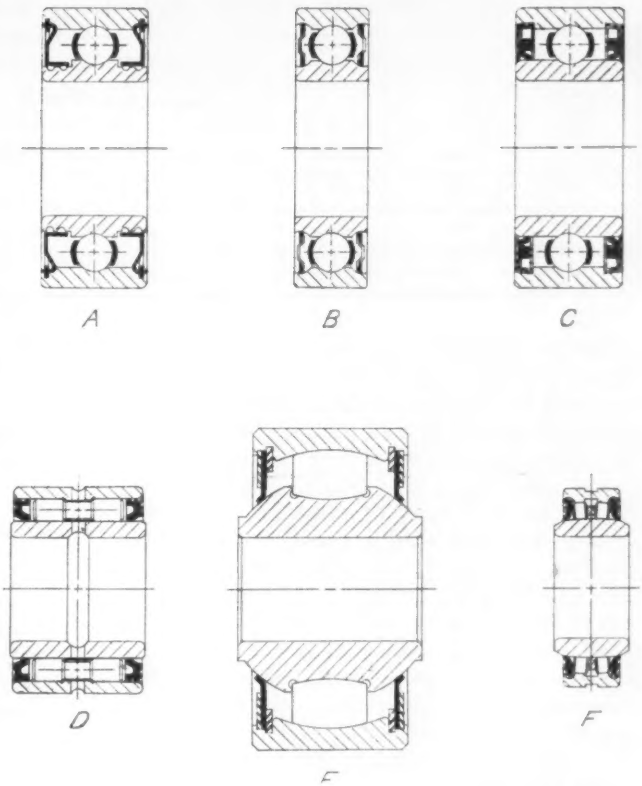
Design of Bearing Housings

The housing in which the bearing is mounted is of major importance in any machine design. When considering a housing for any bearing mounting it is vital to make provision for lubrication and sealing. No iron-clad rule can be followed in designing housings for ball and roller bearings as they are used in so many types of equipment and under such a variety of operating conditions. However, they should be of sufficient cross-sectional thickness to prevent distortion under loads. Also, to avoid the possibility of particles of material (from which the housing is made) or core sand from flaking off and getting into the bearings, the interior of the housings should be coated with an oil-resistant paint or enamel. Housings should be inspected to see that the oil and grease holes are in the proper location and open, and also, that drain plugs or drain-backs are provided.

An ideal housing for a ball bearing is shown in Fig. 24. This housing not only has a wall of suitable thickness but it makes ample provision for sealing and lubrication. This design offers the advantage of extended intervals between greasings. The grease is applied through a hydraulic fitting at a point close to the right-hand side of the bearing cage, and works its way through the spaces between the balls of the bearing. The grease fitting is of the pressure-relief type. This arrangement will guard against over-lubrication and the possibility of blowing the seals out of the housing.

The risk of insufficient lubrication is obvious, but the dangers of over-lubrication are just as

Fig. 23. In these various types of sealed ball and roller bearings, the bearings, seals, and lubricant are combined in a single unit to minimize maintenance



serious, resulting in power losses, overheating caused by internal friction, excessive wear, and waste of lubricant. In the housing design shown in Fig. 24, a sump is provided at the left to trap worn-out grease and sludge. A plug is provided at the bottom of the sump to drain out old grease. Two spring-loaded, lip type synthetic rubber seals are used in this housing to retain lubricant and exclude extraneous matter.

Housing bores should be precision machined to conform to the recommended diameters and tolerances set up by the bearing manufacturers in order to provide the proper fit. Shoulders in the housing should be square, with the corners broken to avoid burrs and nicks. Dimensions of the shoulders should not be less than the minimum specified by the bearing manufacturers.

Although solid housings are preferred for bearing mountings, it is sometimes necessary for assembly or other reasons to use a split construction. Where split housings are required, care should be exercised to avoid distortion of the outer race when the two halves of the housings are bolted together. Where space permits, solid sleeves within the housing should be used to prevent peening or looseness. In any case, the two halves of the housing should be accurately doweled in position during machining and when mounting the bearing.

Lubrication of Bearings

Anti-friction bearings in modern machines are lubricated with either oil or grease. Although anti-friction bearings require a surprisingly small amount of lubricant for their successful and efficient operation, they do need some to lubricate the surfaces which are in contact, such as balls, rollers, and the separators or cages which keep them apart.

When properly applied in the right place and in the correct amounts, lubricants minimize friction between the rolling elements. They also protect the highly finished surfaces of the bearings from corrosive action and help to carry heat away. Also, in some roller bearings of the cylindrical and tapered types, lubrication is necessary between the guide flanges at the ends of the rollers to reduce friction and wear at these points.

Sometimes it is difficult for the user to decide whether oil or grease is the best lubricant to use in a machine or mechanism equipped with anti-friction bearings. There is no firm rule to follow in this respect. Some pieces of equipment will operate equally well with either oil or grease, whereas there are others where one type is clearly indicated. When in doubt the bearing manufacturer or lubricant specialist should be consulted for proper recommendation. Where bearings operate under moderate conditions of speed, say 500 R.P.M., and moderate temperatures, they can be safely lubricated with grease, since relatively simple seals or closures can be used to retain the grease within the housing.

In some cases, the energy required to churn or push aside the lubricant in a ball or roller bearing may be considerably higher than the normal rolling friction in the bearing itself. For this reason, careful consideration must be given to the extent to which a grease may develop churning. At low loads, churning may be particularly objectionable, especially where power consumption is a factor, as in aircraft control bearings at low temperatures, textile machines, or small motors.

Frequency of Grease Lubrication for Ball or Roller Bearings

Bearing Operation, Hours per Day	Time Interval in Weeks between Greasings — Speed of Operation, Revolutions per Minute							
	1-250	250-500	500-750	750-1000	1000-1500	1500-2000	2000-2500	2500-3000
8	12	12	10	7	5	4	3	2
16	12	7	5	4	2	2	1	1
24	10	5	3	2	1	1	1	1

Special lubrication problems should be referred to the bearing manufacturer or lubricant specialist for recommendations. When requesting recommendations, give all pertinent data regarding operating conditions, such as shaft speeds, size of bearings, type of bearing load (both radial and thrust), hours of operation, and special conditions of heat, dirt, and moisture. If trouble has been experienced with a lubricant, give complete details of the trouble, as such information may help in making proper recommendations. Often, mechanical failure is blamed on faulty machine design, bearing construction, or materials when actually the trouble is due to improper lubrication. This does not necessarily imply that the lubricant was inferior; possibly it was the wrong lubricant.

Lubrication of bearings should be given a high priority in machine maintenance to make sure that the proper lubricants are correctly applied at the right time and in the specified amounts.

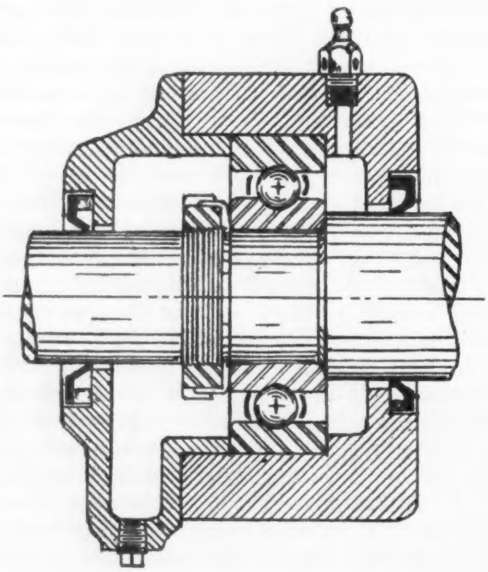


Fig. 24. Ideal ball-bearing housing has pressure-relief type grease fitting close to bearing, and a sump with drain plug for removing worn-out grease or sludge

Frequency of lubrication depends upon operating conditions and the type of equipment in which the bearings are used. In case of oil lubrication the combined effects of temperature, time, and agitation determine frequency of lubrication.

Frequency and Amount of Grease Lubrication

For grease-lubricated ball or roller bearings such as found in pillow blocks, the frequency of lubrication recommendations given in the accompanying table can be safely used as a guide. The amount of grease to be used depends on the size and type of bearing, operating conditions, and the design of the housing. However, the approximate amounts of grease to be added at each relubrication period are as follows:

Bearing Bore (Shaft Size), Inches	Amount of Grease, Ounces
1/2 to 3/4	3/4
3/4 to 15/16	3/4
15/16 to 1 3/16	3/4
1 3/16 to 1 15/16	1
1 15/16 to 2 15/16	1
2 15/16 to 5	2

To make sure that only the correct quantity of the proper lubricant is applied at proper intervals, it is advisable to adopt some form of identification system. One method consists of attaching a metal tag to each lubrication fitting, as seen at left in Fig. 25, or pasting a decalcomania to each bearing housing, as shown at the right. The tag or decalcomania carries a series of numerals, the first numeral indicating the number of strokes of the grease gun required to supply the correct amount of lubricant; the second numeral giving the identification number of the lubricant to be employed; and the third numeral showing the frequency of lubrication. For the frequency numeral, 1 indicates yearly lubrication; 2, semi-annually; 4, quarterly; and 12, monthly.

By following this plan, maintenance men are

informed at a glance which bearings require lubrication, and how much of what lubricant is to be applied. For instance, the tag and decalcomania illustrated indicate that three strokes of the grease gun are necessary to supply the required amount of lubricant. The numeral 2 identifies the lubricant to be used, and the numeral 4 shows the frequency of lubrication, which, in this case, is every three months. This system saves time and work, and eliminates the necessity of consulting records for each machine.

Where bearings operate under moderate conditions of speed (under 4000 R.P.M.) and temperature, they can be safely lubricated with grease or grease products. In cases of this kind, relatively simple seals such as grease grooves and felt can be used to retain grease in the bearing housing.

Oil is generally required for the lubrication of ball and roller bearings operating at speeds above 4000 R.P.M., and at high temperatures. Also, in many types of mechanisms, such as automotive and tractor transmissions, oil can be used for lubricating parts of the unit as well as the bearings themselves. The use of oils in many machines may have been avoided in the past because of the possibility of leakage; but it has now become feasible and commercially practicable by employing oil-tight unit or lip type, synthetic rubber and leather seals, as shown in Fig. 20, Designs F and G.

Cleaning of Anti-Friction Bearings

As it is not always possible to provide adequate sealing or to depend upon the seal being in proper condition, ball and roller bearings in service where dirty conditions prevail should be flushed and cleaned periodically. Experience has proved that bearing life can be materially lengthened by such attention.

Oil lubrication has the advantage that it is relatively easy to determine the amount of oil in a housing. Also, in many cases it is possible to drain and replace the oil without disassembling the housing.

Assembled ball and roller bearings are often cleaned by spraying with Stoddard or similar solvent from an air gun. Air is supplied to the gun at a pressure of from 55 to 60 pounds per square inch after it has been cooled to room temperature and filtered. At the cleaning station, the air passes through a mechanical separator and a stone filter before reaching the gun.

An air gun used for cleaning bearings should be of the two-position type so that when the trigger is squeezed half way, only pure dry air passes through the gun. Pulling the trigger through its full travel will yield a mixture of air and solvent.

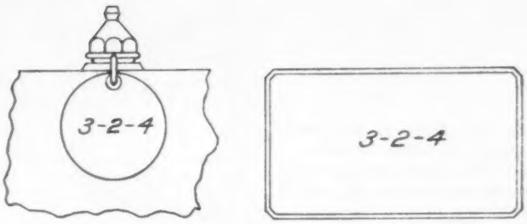


Fig. 25. To facilitate maintenance, tag can be attached to lubrication fitting (as seen at left) or decalcomania (right) can be applied to bearing housing

The cleaning procedure is quite simple, yet effective. It consists of laying bearings on a screen, placing the screen in a spray booth, and spraying both sides of the bearings. The bearings should then be dried, while still on the screen, by blowing with dry air from the gun. Immediately after drying, the bearings should be lubricated and wrapped in oil-proof paper and stored. All of these operations should be done in a room in which the air is controlled for both temperature and humidity.

If this method of cleaning cannot be followed, the bearings should be put in a rectangular wire basket and placed in a tank for soaking and washing. The bearings should be soaked long enough to loosen the grease and dirt. This may take several hours or longer, and then the bearings should be sloshed around near the top of the tank until they are clean. After thorough clean-

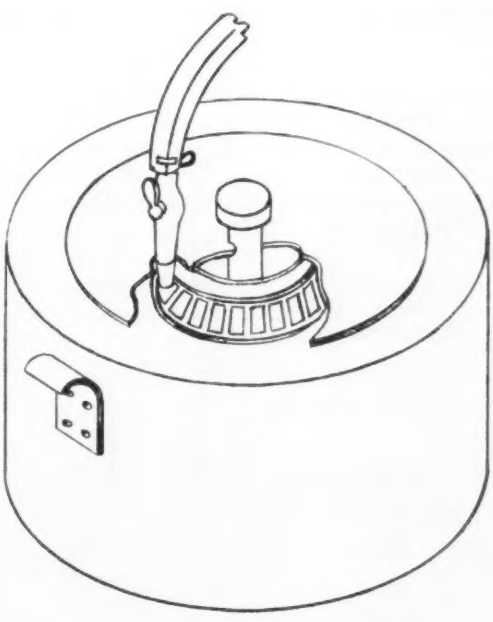


Fig. 26. Special bearing cleaner used by aircraft manufacturer to remove rust preventive from new tapered roller bearings before they are installed in wheels

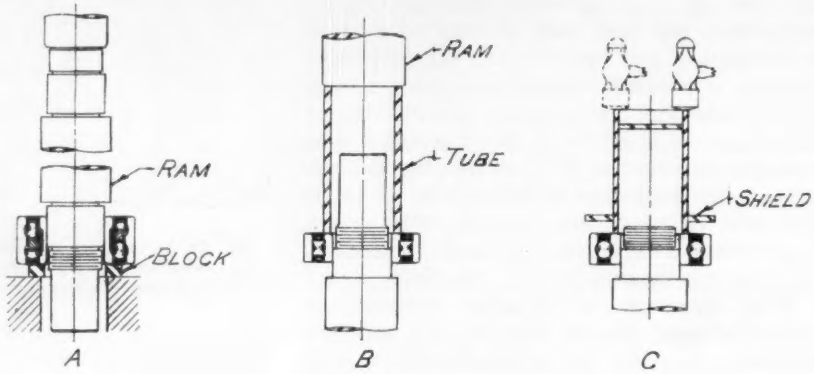


Fig. 27. Bearings can be applied to shafts or other parts by means of an arbor press, as seen at (A) and (B), or with a hammer (C), applying even pressure to inner race

ing, the bearings should be wrapped in grease-proof paper, to keep the lubricant from escaping, before being placed in boxes or cartons. If no cartons are available, the bearings should be wrapped in water-resistant paper and marked for identification.

Although not generally recommended, there are instances where bearing users desire to remove the rust preventive from new bearings before installation. For example, one of the leading aircraft manufacturers desired to remove this rust preventive from new tapered roller bearings before installing them in aircraft wheels. During the final assembly the compound had to be removed, and the bearings packed with the specified lubricant. Removing of the rust-preventive compound posed a problem which was solved by developing the special bearing cleaner seen in Fig. 26.

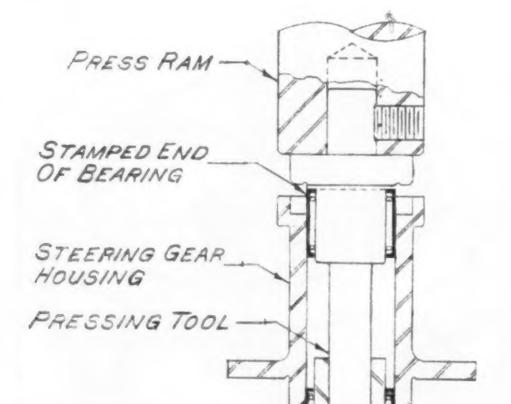


Fig. 28. Arbor press set up for inserting needle bearings (having thin-section outer races) into steering-gear housing to avoid damaging the fragile bearings

Formerly, the bearings were immersed in a solvent to loosen the rust-preventive compound, and then air pressure was used to clean the material from between the races and rollers where it had become slightly hardened. The solvent and compound splashed in all directions, the operator's clothes became soiled, and the floor was covered with the greasy matter.

With the new method, bearings are clamped to the under side of the cover of the special cleaner. A revolving plate, placed on top of the cover, is provided with a hole to receive the nozzle of an air hose. In use, air is blown through the opening, while the plate is revolved over the bearing rollers and races. The air streaming past the rollers and races carries away the compound.

The revolving plate with the small opening protects the operator, and the can receives the used compound. The user of this cleaner states that this simple operation saves twenty minutes per airplane, which includes the time previously required to clean up the work area after a bearing installation. This cleaner not only proved to be a time saver but also helped the workmen to foster good housekeeping. The device is equally effective when cleaning bearings that have been in service.

Installation of Ball and Roller Bearings

Bearing manufacturers put much time, energy, and money into producing useful maintenance books that will answer most of the bearing users' questions regarding the installation and care of bearings. The installation instructions given in such books should be followed carefully. A bearing that is installed properly saves the user many future headaches, and insures top-notch performance.

Ball and roller bearings must be handled and installed with great care to avoid damaging them, and to prevent abrasive dust and dirt from gaining admittance. The importance of the latter pre-

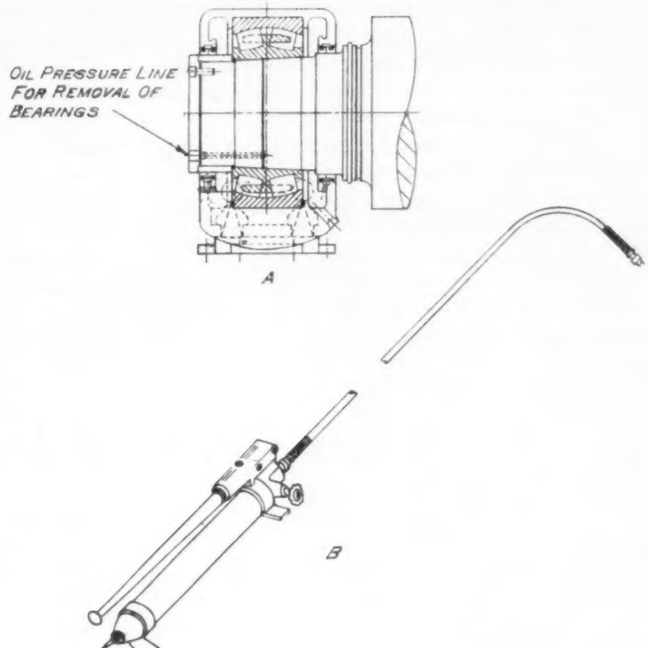


Fig. 29. Special device shown at (B) is used to inject high-pressure oil into bore of large bearings, such as the one seen at (A), to facilitate both installation and removal

caution can be better understood when it is realized that more than 90 per cent of ball and roller bearing failures are caused by dirt.

When applying a ball or roller bearing to a shaft or other part, always apply an even pressure to the inner race only, if possible. This may be accomplished in various ways depending upon the type of bearing, its mounting, and the installation tools available. When an arbor press is available, the bearing inner race should be supported by a pair of flat blocks of exactly the same height, as shown at *A*, Fig. 27. A method of applying a cylindrical roller bearing to a shaft is illustrated at *B*. Pressure is applied to the inner race by means of an arbor press, through a length of clean tubing having square ends. When an arbor press is not available, a bearing may be applied to a shaft by means of a length of tubing and a hammer, as illustrated at *C*. Large bearings are sometimes heated by pouring hot oil over them to expand the inner race so that the bearing can be fitted on the shaft readily.

Needle bearings having thin-section outer shells should never be forced into housings by tapping directly on the outer race, as this procedure is apt to damage the bearing permanently. Such bearings may be pressed into place by an arbor press as shown in Fig. 28. It is desirable to have positive stops on the press tool to prevent pressing the bearings beyond their intended locations, and it is imperative to have such stops if the bearings are to be pressed into a shouldered hole, to guard against pressing the bearings against the shoulders. Also, it is best to have a leader or pilot as illustrated.

The removal of bearings from shafts usually entails just the reverse procedure from that employed for installation. However, sometimes a separable inner race from a cylindrical roller bearing is installed against a shaft shoulder having a diameter equal to that of the inner race, so that there is no way to get hold of and remove it from the shaft. In cases like this, the inner race should be left on the shaft if it is usable. If not, it should be cut off with a torch by burning it part way through. If it won't loosen enough to pull off, it should be cracked with a chisel.

Large bearings installed with a press or shrink fit on journals have always posed a difficult problem of removal. In view of this, large roller bearings on steel rolling mills were always installed with a loose fit which allowed the inner race to

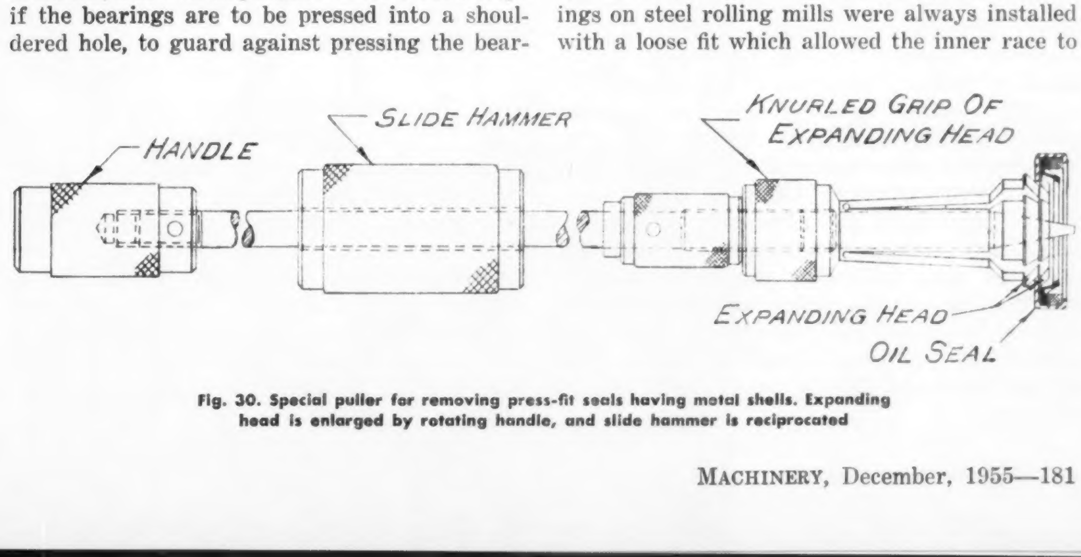


Fig. 30. Special puller for removing press-fit seals having metal shells. Expanding head is enlarged by rotating handle, and slide hammer is reciprocated

creep on the roll neck. The result was inevitable wear and scoring of the bearing bore and roll neck, thus affecting the quality of the work done. This problem has been overcome by the development of an oil injection system which greatly facilitates both the installation and removal of large taper and straight bore bearings. This system is illustrated in Fig. 29, which shows a paper-mill bearing application at *A*. Friction between the contact surfaces during fitting and dismantling can be almost entirely eliminated with the injection of oil under pressures of 2500 to 10,000 pounds per square inch by means of the unit shown at *B*. When dismounting, the system accomplishes complete removal of the bearing.

The removal of press-fit seals having metal shells from housings has always posed a problem for seal users. This problem has been solved by the development of a puller, Fig. 30. This puller operates by placing the expanding head into the oil seal and holding the knurled grip of the expanding head in the left hand. Then, the handle is rotated to the right until the expanding head is enlarged to contact the seal shell. Finally, the slide hammer is reciprocated to remove the seal.

A.G.M.A. Holds Semi-Annual Meeting

AT the semi-annual meeting of the American Gear Manufacturers Association, Marvin R. Anderson, president, announced that gear business this year was 15 to 20 per cent better than in 1954. The meeting was held at the Edgewater Beach Hotel, Chicago, Ill., from October 23 to 26, inclusive.

During the sessions, the first meeting of the newly formed Machine Tool Gearing Task Committee was held. J. M. Claflin, Warner & Swasey Co., is chairman of this committee. Their first project will be to evaluate machine tool gearing requirements, and determine which A.G.M.A. standards are applicable, as well as decide which new ones are necessary. An interim meeting was planned, and will be held prior to the annual meeting of the Society, June 3 to 6, 1956.

Announcement was made that the Aircraft Gearing Committee would be split into four groups: one for engine and power take-off gearing, a second for actuators and airframe gearing, a third for aircraft instrument and control gearing, and the fourth for guided missile and rocket gearing. This committee is preparing a proposed standard on aircraft bevel gears. Other committees in the Speed Reducer and Gearmotor, General Gearing, Development, and Industry Problems Divisions of the Association adopted, revised, or considered preliminary drafts of various data sheets and standards.

During one of the technical sessions, Norman Gates, chief metallurgist, Lindberg Steel Treating Co., presented a paper entitled "Minimizing Gear Heat-Treating Headaches." He emphasized the close association necessary between heat-treating and the design and manufacture of gears. Judicious steel selection is most important, and an attempt should be made to provide symmetry and uniform sections in designing the gears.

Mr. Gates pointed out that carefully controlled heating and cooling are essential to keep stresses uniformly distributed. Sources of distortion are machining stresses, non-uniform heating, or improper quenching. Pertinent information about induction- and flame-hardening, heat-treating furnaces, and hot-quenching was also presented in this interesting talk.

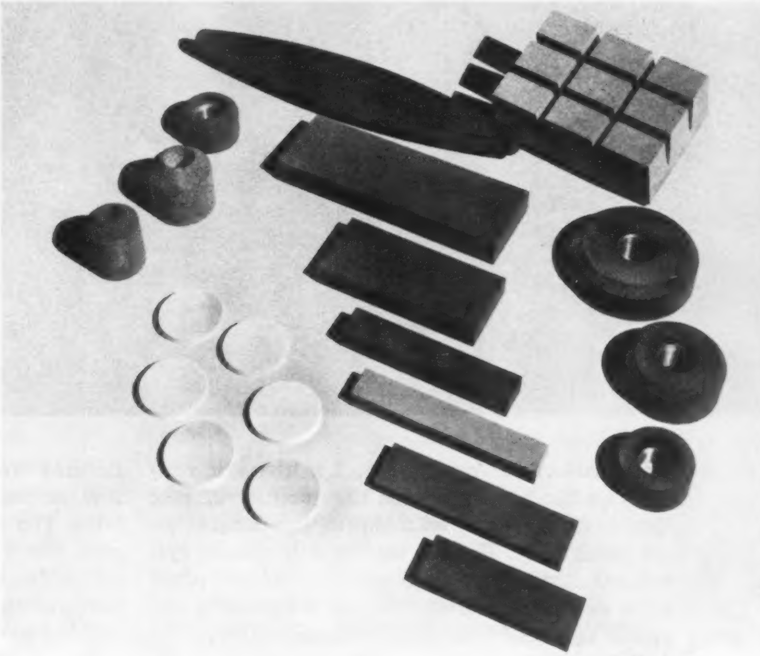
"The Torque Converter in Power Transmissions" was the title of a paper given by P. L. Fosburg, manager of engineering, hydraulic drives department, Westinghouse Electric Corporation. Mr. Fosburg traced the history of converters and described specific applications. It was pointed out that converters are ideal for variable loading conditions since they provide high starting torque, permit a smooth gradual application of power, require a minimum of skill on the part of the operator, and allow the engine to be operated at an efficient speed at all times. Diagrams were shown to explain the flow of oil through the converter during various conditions, and charts illustrated the operating characteristics, efficiency, and torque.

* * *

Iron Impurities "Led" Out of Titanium Bars

Cage-zone refining, a method of obtaining high-purity titanium for research work, has been developed by metallurgists at the Westinghouse Electric Corporation's laboratories. When a bar of impure titanium is melted progressively from end to end, the iron, a common impurity in titanium, concentrates in the liquid metal and follows the molten zone to the end of the bar. Each time the process is repeated, more impurities are removed.

Hydraulic Presses Compact Small Abrasive Wheels



By S. SPICER KENYON
Production Engineer
The Carborundum Company
Niagara Falls, N. Y.

THE demands for abrasive products in relatively small sizes have increased substantially within the past few years, outmoding conventional, costly, hand fabricating methods. Engineers of both the Denison Engineering Co., Columbus, Ohio, and the Carborundum Company, Niagara Falls, N. Y., have cooperated to devise a system of compacting abrasive mixes into the final desired shapes by the use of hydraulic presses.

This system has proved highly effective. Not only has product quality been improved and a considerable amount of floor space saved by this method change-over, but also production increases of more than 50 per cent have been realized in the pressing of aluminum oxide, silicon carbide grains, and ceramic mixes into individual sharpening stones and wheels. On pieces requiring molding and cutting, production rates have been increased more than 100 per cent by the bank of 4- and 8-ton capacity "Multipresses" illustrated in Fig. 1.

From the mixing rooms the prepared mixture of required abrasive materials is delivered to the press area. Wax is used as the bonding agent and is disposed of during subsequent vitrification. The operator manually scoops the mix into a hopper mounted slightly above the extended

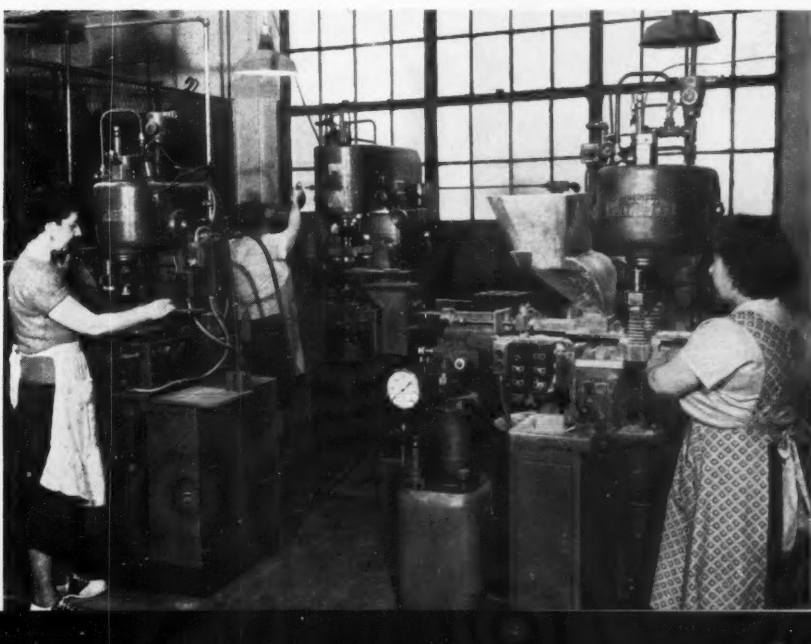


Fig. 1. Bank of 4- and 8-ton hydraulic presses being used to compact an abrasive mixture into small grinding stones and wheels

Fig. 2. Abrasive mixture is shown being scooped into a hopper from which it is automatically metered and delivered to the molds

press table as shown in Fig. 2. Automatic controls on the hopper govern the quantity of mix that is discharged into a shuttle box located on the press table. Upon actuating a hydraulic cylinder located at the left-hand end of the press table extension, the shuttle box is forced to the right, carrying with it a metered quantity of abrasive material. The mix is delivered to molds formed in the die platen.

When the shuttle box returns to its original position beneath the hopper, the press ram, which has been pre-set to provide the proper pressure, descends to compress the mixture in the molds. As the ram is retracted, the formed material is elevated to the level of the press table by an ejection arm located beneath the platen. During the next operating cycle, the shuttle box pushes the finished work from the ram area onto a perforated platform at the right-hand side of the table. The molded pieces are then placed in saggers, Fig. 3, to be transported to kilns for vitrification. Depending on both the size of the abrasive part and the mix, cycle time from shuttle box to finished part takes no more than five seconds.

Where abrasive dust is a problem, exhaust hoods remove gritty particles from the work area. Moving parts of the press are protected against abrasive wear with rubber covers and sleeves. Due to the simplicity of this procedure, operators attain a high degree of efficiency with little training. All that is required is to start the cycle and remove the finished pieces. Dies and molds can be easily changed to accommodate work of other shapes and sizes.

Fig. 3. Sharpening wheels, after being compacted and ejected from the hydraulic press, are stacked up prior to vitrification

Aluminum Grinding Practice

FOR many years, the grinding of aluminum was considered to be difficult and unsatisfactory. Wheel loading was a principal drawback, along with poor finish and excessive heating.

Today, as explained in the recent book *Machining Kaiser Aluminum*, published by Kaiser Aluminum & Chemical Sales, Inc., Chicago, Ill., the grinding of aluminum is done readily and economically when correct procedures are followed. To produce ground finishes requires special types of wheels and coolants, as well as definite handling technique. Work speed for aluminum is normally double that employed for ferrous metals, while the depth of cut is less. Work traverse is relatively fast. This combination minimizes the pressure between the wheel and work, thus reducing the tendency to load the wheel.

Sharpness and ability to cut free and clean are essential for wheels used in grinding aluminum. Proper grain and grade are important. If too coarse, the wheel will leave a poor finish; if too fine or too hard, it will clog or glaze, causing overheating; and if too soft, it will wear rapidly.

A free-cutting silicon carbide wheel in a flexible base is generally preferred. Aluminum oxide wheels are not recommended except for cut-off wheels and for certain abrasive belt applications. Wheels of medium hardness, of about 30 grit, in a synthetic resin bond have been found to work most successfully in roughing work. For finishing, a finer grit (up to 54) in a vitrified bond is popular. Because the silicon carbide is more brittle, the abrasive grits fracture readily in aluminum, presenting a constantly changing sharp surface to the work.

A moderate-to-fast table traverse is commonly used for roughing, with a somewhat slower traverse for finishing. Wheel speed for roughing can run between 8000 and 9000 feet per minute, with finishing at about 6500. The softer aluminum alloys are not so easily ground as free-machining alloys. Finishes are less satisfactory and wheels load more quickly. Nevertheless, a good quality finish can be obtained with proper lubrication, wheel type, and work and wheel speeds. A wheel unsuited for a particular operation can be adapted sometimes by changing its speed. For instance, if a wheel acts too soft, speed can be increased for a harder action.

One development in grinding wheels, called "variable density," eliminates the need to increase wheel speed as it wears in order to maintain its surface feet-per-minute rate. This is done by constructing the wheel so that its density increases from its periphery to its center.

To keep a wheel face open and free-cutting in aluminum, special lubricants must be used. At one time, straight kerosene was employed, but this made an unpleasant condition for the operator, as well as creating a fire hazard. The addition of carbon tetrachloride removed the fire hazard, but not the poor working condition.

At present, most oil companies, coolant manufacturers, and some machine tool builders are marketing soluble oil solutions that have proved satisfactory for grinding aluminum. A neutral solution is recommended. Water-mixed fluids like soluble or emulsifiable oils stay in solution without much trouble unless the water is unusually hard. Addition of a wetting agent is sometimes helpful, and in any event, the water should be agitated thoroughly as the mixing is being done.

Although emulsions of about 35 to 1 are common, a better cushioning effect, as well as less clogging of the wheel, is often obtained from a much lower ratio. One shop, in grinding soft castings, went progressively from a 20 to 1 to a 6 to 1 mixture before obtaining satisfactory results.

In selecting any grinding fluid for aluminum work, consideration should be given to performance, tendency toward becoming rancid, gumming, and foaming. Straining the circulating coolant before it returns to the work will give better finishes. For rough-grinding, where stock removal is the primary objective, generous applications of wax or stick grease of various grades are often satisfactory. This type lubricant is resorted to where applying liquids is impractical.

Because of the high coefficient of thermal expansion of aluminum, there is always the danger of heat distortion. This is especially true when grinding between centers. Adequate coolant prevents excessive heating of the work, and aids in carrying off the particles of metal and abrasive.

* * *

Automatic Flight Recorder

Flying may be made safer by the accumulation of information obtained from an automatic flight recorder now being produced by General Mills, Inc., Mechanical Division, Minneapolis, Minn. The instrument measures indicated air speed, static pressure, altitude, vertical acceleration, compass heading, and time. Designed to resist the impact of a crash and the heat of a fuel fire, the device is expected to provide a reliable means for analyzing and studying aircraft failures.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

High Nickel Alloy Cast Metal that is Ductile

A high nickel alloy cast metal that exhibits ductility as well as corrosion resistance has been announced by the International Nickel Co., Inc., 67 Wall St., New York 5, N. Y. Known as "Ductile Ni-Resist," it contains spheroidally shaped free or graphitic carbon with a minimum number of discontinuities surrounding the carbon. This imparts strength, toughness, and ductility to the material.

Mechanical properties of this alloy are essentially as follows: tensile strength, 58,000 to 65,000 pounds per square inch; yield strength (0.2 per cent offset), 32,000 to 35,000 pounds per square inch; and elongation, 8 to 20 per cent. Besides being ductile and corrosion resistant, the material also possesses erosion- and wear-resistance, toughness, low-temperature stability, castability, and machinability. It has been used successfully in aircraft and chemical equipment, pumps, and compressors.

High-Strength Aluminum-Alloy Conductor Material

A lightweight high-strength aluminum-alloy conductor material has been announced by Revere Copper and Brass Inc., 230 Park Ave., New York 17, N. Y. This alloy, designated "Revere Alloy 6263," has the following nominal chemical composition: iron, 0.40 per cent, maximum; silicon, 0.30 to 0.60 per cent; magnesium, 0.40 to 0.80 per cent; and the balance, aluminum. A comparison of this material which is available in both T6 and T8 tempers is made with an EC grade aluminum and hard copper in the accompanying table.

Cement for Joining Metallized Plastics to Each Other

A clear cement for adhering metallized plastic to itself or to plain plastic without causing the metallic finish to peel or run has been announced by the Adhesive Products Corporation, 1660 Boone Ave., New York 60, N. Y. Called "3799 Metagrip," this quick-drying cement can bond such materials as metallized acetate, butyrate, or polystyrene and can withstand considerable shock. It can be applied by brush, spray, dip, or squeeze applicators. Other uses include the adhering of plastic to metal in the manufacture of novelties, toys, and plastic household items.

Heat-Treated or Annealed Lead-Bearing Steel Available

A fine-grained, medium-carbon alloy with a 0.15 to 0.35 per cent lead addition has been announced by Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill. "New Rycut 50," as it is called, responds well to the conventional oil-quench and temper method of heat-treatment. It may also be hardened by both the flame and induction processes with assurance of good results. For machining it is suggested that starting speeds and feeds comparable to those employed with AISI C1141 be used and increases made until the optimum rates are reached.

Comparison of Physical Properties of Various Electrical Conductor Metals

Alloy and Temper	Thickness, Inches	Minimum Tensile Strength, Pounds per Square Inch	Minimum Yield Strength, Pounds per Square Inch	Minimum Electrical Conductivity, Per Cent (IACS)	Density, Pounds per Cubic Inch
6263-T6	Up to 0.500	29,000	25,000	55	0.098
6263-T8	Up to 0.500	29,000	25,000	57	0.098
EC-H17	Up to 0.500	17,000	15,000	61	0.098
Copper (Hard)	Up to 0.375	37,500	....	97.4	0.323
Copper (Hard)	Over 0.375 to 0.500	33,000	....	98.4	0.323

The alloy is available in bar form in both the annealed and heat-treated ready-to-use (machine straightened and stress relieved) forms. In the annealed condition the alloy exhibits the following properties: surface hardness, 302 to 401 Brinell; tensile strength, 138,500 to 202,500 pounds per square inch; yield strength (0.2 per cent offset), 105,000 to 184,000 pounds per square inch; and reduction in area 39.4 to 54.7 per cent. Exact values in any particular range depend upon the tempering temperature and the outside diameter of the piece. Properties of the heat-treated, ready-to-use alloy range as follows, depending upon the size of the piece: hardness, 255 to 341 Brinell; tensile strength, 115,000 to 140,000 pounds per square inch; yield strength (0.2 per cent offset), 85,000 to 120,000 pounds per square inch; elongation in 2 inches, 15 per cent; and reduction in area, 40 to 50 per cent.

The new metal has the following composition: carbon, 0.45 to 0.53 per cent; manganese, 0.75 to 1.00 per cent; phosphorus, 0.040 per cent max.; sulphur, 0.040 per cent max.; silicon, 0.20 to 0.35 per cent; chromium, 0.80 to 1.10 per cent; molybdenum, 0.15 to 0.25 per cent; lead, 0.15 to 0.35 per cent; and iron, the balance. In the heat-treated form the metal can be used for brake dies. Other uses include spindles, collets, gears, shafts, tools, and mandrels.

Silicone Rubber that Remains Flexible at 600 Degrees F.

A silicone rubber that remains flexible at 600 degrees F. has been announced by the Silicone Products Department, General Electric Co., Waterford, N. Y. Designated Class 700, this material will remain flexible for 150 hours or longer during continuous exposure to a 600-degree F. heat. Other properties include resistance to ozone, aging, and weathering; low-temperature flexibility; and low-moisture absorption. This rubber is suitable for molding, extrusion, or calendering fabrication methods. Uses include oven door seals and parts for hot materials-handling equipment in the glass, ceramics, and metals industries.

Heat- and Chemical-Resistant Plastic is Readily Machinable

A plastic that combines mechanical strength, heat and chemical resistance, dimensional stability, and free machinability has been announced by the Polymer Corporation of Pennsylvania, Reading, Pa. The material, known as "Polypenco K-51," is available in rod form in sizes up to 2 inches in diameter. It is said to resist the effects of many alkalies and organic and inorganic acid solutions at both room and boiling temperatures. Heat-distortion temperatures for the new material are 185 degrees F. for a 264-pound per square inch load and 300 degrees F. for a 66-pound per square inch load. Unless it is in a non-oxidizing atmosphere the plastic is not recommended for continuous use above 250 degrees F. Tests have indicated that the material has zero water absorption.

Parts machined from the Polypenco K-51 offer users an economical plastic medium that is high in strength, has heat and chemical resistance, has dimensional stability, and can be easily machined.

Mechanical properties include a tensile strength of 6000 pounds per square inch and a hardness of 100 on the Rockwell R scale at a temperature of 73 degrees F. The material can be used for bearings, rollers, and gears that are operated under severe corrosive conditions. Pump impellers, valve seats, gaskets, packings, and similar parts can also be made from this material. The accompanying photograph shows some parts machined from this plastic.

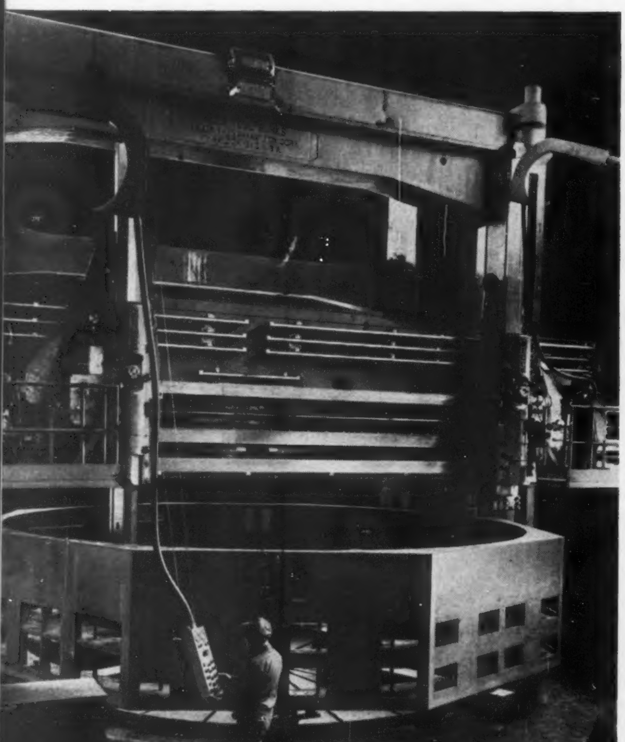
Nylon Fastenings have Now Become an Open-Stock Item

The development of an on-hand stock inventory of various all-nylon fastenings has been announced by the Anti-Corrosive Metal Products Co., Inc., 1234 River Road, Castleton-on-Hudson, N. Y. The name under which these fastenings will be marketed is "Nylo-Fast." Present inventories of these fastenings include many of the popular sizes of machine screws. They are only one-sixth the weight of stainless steel and one-half the weight of aluminum. These fastenings will give and take against other surfaces, locking in place to eliminate loosening under vibration. In addition they will resist high voltages at commercial frequencies, withstand heat up to 450 degrees F., and are unaffected by commercial solvents, alcohols, gasoline, oils, and boiling 40 per cent caustic soda.

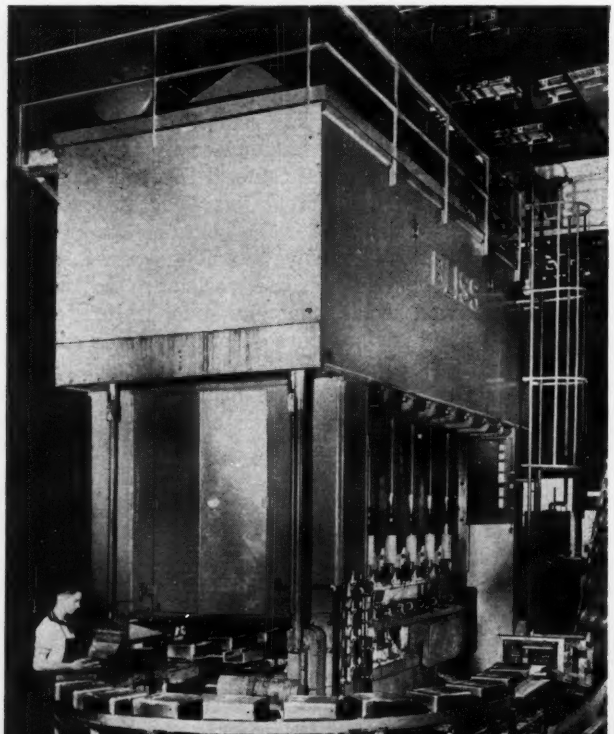
In Shops Around the Country

Camera highlights of some interesting operations performed in various metal-working plants throughout the nation by unique applications of machines and tools

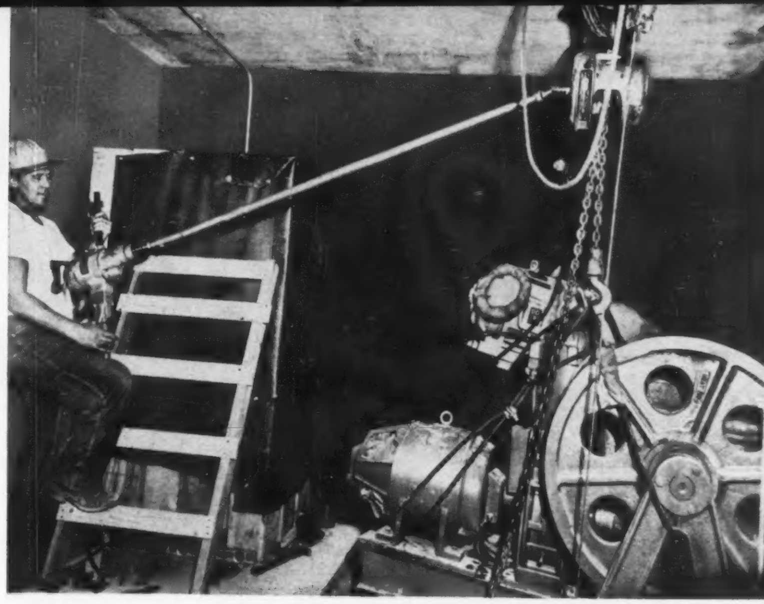
Machining the stator frame of a 20,000-K.V.A. generator on a 30-foot Niles adjustable rail vertical boring mill recently installed at the Elliott Co., Jeannette, Pa. Elliott is building two of the umbrella type generators for the Imperial Valley Irrigation District, Pilot Knob, Calif.



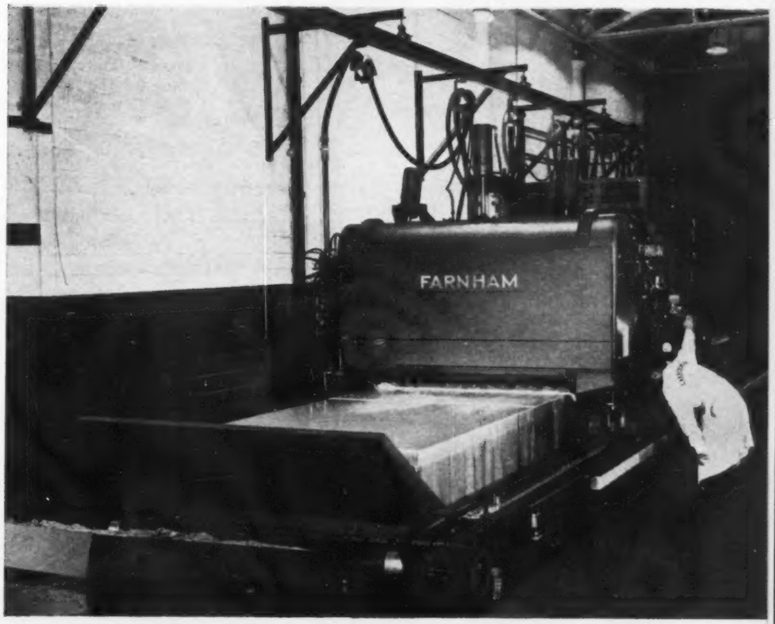
An endless parade of refrigerator pans leaves a 700-ton Bliss transfer feed press at General Electric's Appliance Park, Louisville, Ky. In the seven-station press, the pans are deep-drawn at a rate of twelve per minute, then moved up on a conveyor to pickling and enameling operations.



A 3/4-inch Black & Decker electric drill powers a block and tackle for the General Elevator Co., Baltimore, Md. The company uses the rig for installing its elevators. Here it is shown raising equipment that weighs 2570 pounds a height of six floors.



A Farnham belt grinding machine tapers aluminum aircraft skins at the Coated Abrasives Division of Carborundum Co., Niagara Falls, N. Y. The machine, claimed to be the largest of its type, weighs 80 tons. It has a capacity for handling work up to 86 inches wide, 40 feet long, and 12 inches thick.



At the Ford Aircraft Engine Division, Chicago, Ill., rear bearing support blanks are cold-rolled to form over a hardened arbor on a Lodge & Shipley "Floturn" lathe. A hydraulic shaft holds the blank against the arbor under the tremendous pressure of the roller.

Machine Tool Builders Reflect on the Show

Louis Polk, newly elected president of the National Machine Tool Builders' Association

THE highly successful show recently held in Chicago by the National Machine Tool Builders' Association was frequently referred to in glowing terms from the speaker's platform and in member conversations at the fifty-fourth annual meeting of the Association held at the Waldorf-Astoria, New York City, October 24 to 26, inclusive. William E. Rutz, chairman of the Show Committee and executive vice-president of the Giddings & Lewis Machine Tool Co., reported a registration of about 103,000 visitors, most of whom were of exceptionally high caliber in the financial and production circles of industry.

Machine tool builders especially interested in the export market were gratified to learn that there were approximately 1000 visitors from Canada and over 1100 visitors from other foreign countries. Members of the Association will soon receive a list of the registrants with a record of their company, title, and company products.

The actual number of machine tools on exhibition was 917, and every one was of a new design since the last show. The machines had a total weight of 8880 tons and required 1200 trucks and 152 freight cars for transportation purposes. Tribute was paid by Mr. Rutz to the machinery movers and millwrights who handled the huge task of installing the heavy machines, as for example, a 116-ton planer type milling machine.

To M. A. Hollengreen, president of the Association and president of the Landis Tool Co., the Machine Tool Show represented only the opening gun of an all-out sales campaign that the entire industry should now undertake to counteract the obsolescence of a large share of equipment operating in the country's metal-working shops. Despite the large show attendance, Mr. Hollengreen pointed out that there are thousands of top executives who could not attend the show and who, therefore, have little conception of the potentialities embodied in the latest types of machine tools.

The same speaker also dwelled at considerable length on the subject of machine tools from the standpoints of public welfare and national defense. He pointed out that the outcome of the cold war between the United States and the Communist nations may depend in the long run upon the answer to the simple question of which system gives the average man the most out of life. Mr. Hollengreen stated that we are in a position to prove to the rest of the world that all of the people get more of the comforts, conveniences, and luxuries of existence under our competitive system than they get under communism. To continue this proof, it will be necessary for our country to maintain an annual increase in productivity, which means the ability of a man to turn out more pieces of work per hour.

"It is only as machine tools increase productivity and thereby place more merchandise within the pocketbook range of larger numbers of people that the American standard of living under our competitive system continues to advance year after year," said Mr. Hollengreen. He pointed out that in developing machine tools under the profit

motive in a competitive system, the industry is at the same time demonstrating that this system results in the greatest benefits to the largest number of people.

"It is the job of our industry to make certain that the American public will be able, as the years go on, to get more and more of these devices for a higher standard of living in return for a day's work. This can be accomplished by increasing productivity per man per hour; and as we succeed in this objective, we will prove to the world that communism does not and cannot give the people what they want," continued Mr. Hollengreen. He also pointed out that unless industry is able to maintain the rate of increase in the productivity of machines, the United States may in the future be faced with an actual shortage of labor. This conclusion was based on a statistical study of the probable increase in population and the incredibly expanding needs of the American public.

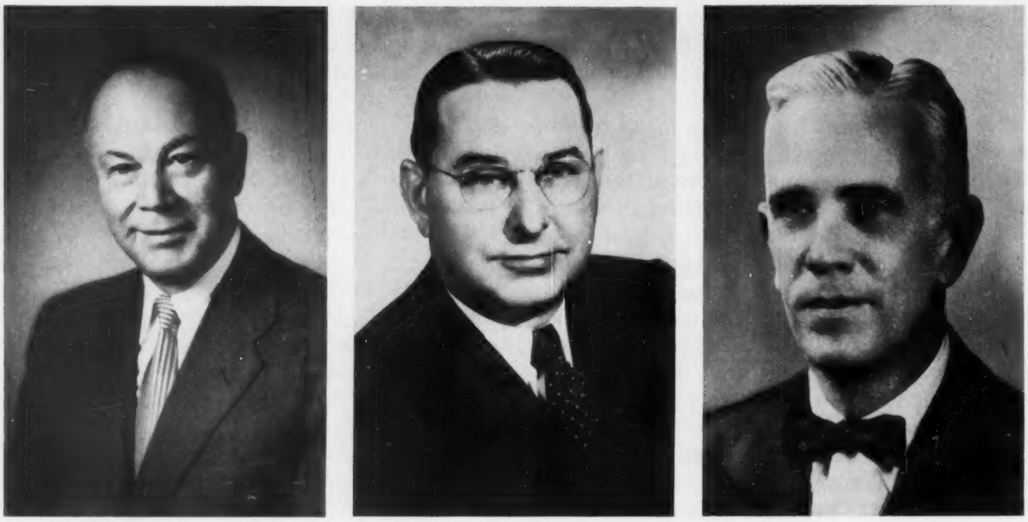
Remarks about communistic ideologies by Mr. Hollengreen served to introduce William L. McGrath, United States Employer Delegate to the International Labor Organization and president of the Williamson Heater Co. According to this speaker, the United States should withdraw from the ILO unless steps are taken to prevent it from becoming dominated by communists. In 1954, Russia, which had long been absent from the ILO, came back in as three countries—the U.S.S.R., the Ukraine, and Byelorussia. They are supported by Poland, Bulgaria, Hungary, Czechoslovakia, and Albania, making a communistic bloc of eight nations that has thirty-two votes as compared to four votes for the United States. The United States pays 25 per cent of the cost of the ILO while the eight communistic countries pay a total of only 14 1/2 per cent.

Even before the Russian re-entry, the ILO was controlled by a socialist government-labor coalition. Both communism and socialism are collectivist systems and, in the words of the speaker, "go down the same line on matters of basic principles." Because of this situation, the ILO will be swamped by Red propaganda, and proposals will go more definitely to the left. Mr. McGrath pointed out that the socialist proposals that are introduced in the House and Senate of the United States as the years go by mostly originate in the ILO, which for years has been the breeding ground for international socialistic legislation.

Tell Berna, elected executive vice-president of the Association at this meeting, after serving as general manager for eighteen years, outlined the reasons for the Show policies of the Association for the edification of members who have become active in these affairs in the years that have intervened since the policies were adopted. He also mentioned that the board of directors has entered into a contract for the use of the Chicago International Amphitheatre for another Machine Tool Show in 1960.

Everett M. Hicks, chairman of the government relations committee and vice-president and general manager of the Grinding Machine Division, Norton Co., emphasized "the apparent lack of reciprocity" in reciprocal trade agreements with respect to machine tools. "Several years ago," in the words of Mr. Hicks, "the United States machine tool tariff was cut in half, from 30 to 15 per cent. We have not been able to

Elected to serve with Mr. Polk are (left to right) Jerome A. Raterman, first vice-president; Alfred V. Bodine, second vice-president; and Perrin G. March, III, treasurer



William E. Rutz (left) is the new secretary of the National Machine Tool Builders' Association. Ralph E. Cross and Charles S. Davis, Jr., (center and right) were elected directors

perceive that any similar action has been taken by foreign countries on the products we sell. Even more important than these are the quotas and other artificial restrictions which are imposed by many foreign countries. England, for example, bars the importation of any machine tool of a class or kind that is made in England.

"Some time ago the French government relaxed its rigid restrictions on the import of machine tools *except on those coming from the United States*. At the same time a compensatory tax was added which, on machine tools, amounts to 10 or 15 per cent. This tax, combined with the tariff and various other documentation and import levies and taxes of various kinds, adds in total about 55 per cent to the cost of an American machine tool when imported into France. We hope that the representatives of the United States will attack these artificial restrictions in order that we may obtain some true reciprocity between the United States and other countries." Mr. Hicks also discussed the procurement policies of our Government agencies, permanent defense capacity, renegotiation, and taxation policy.

Charles W. Stewart, president of the Machinery and Allied Products Institute, delivered an address "Responsibilities of Capital Goods Leadership." John W. Landis, assistant manager, Atomic Energy Division, Babcock & Wilcox Co., gave a lecture dealing with industrial uses of atomic energy.

At the annual dinner, tributes were paid to Mrs. Frida F. Selbert, secretary of the Association, upon the occasion of her retirement after years of service in that capacity that have won her the admiration of the entire machine tool industry. The speaker at the banquet was Harrison E. Salisbury, correspondent of the *New York Times*, who covered his years of experience in Moscow.

Louis Polk, chairman and president of the Sheffield Corporation, was elected president of the Association. Jerome A. Raterman, president of the Monarch Machine Tool Co., was elected first vice-president, and Alfred V. Bodine, president and treasurer of the Bodine Corporation, was made second vice-president and director. Perrin G. March, III, president of the Cincinnati Shaper Co., was re-elected treasurer. William E. Rutz, currently a director, was elected secretary. New directors elected in addition to Mr. Bodine were Ralph E. Cross, executive vice-president and secretary of The Cross Company, and Charles S. Davis, Jr., vice-president of the Lake Erie Engineering Corporation.

* * *

Improved Molybdenum Wire

A new grade of molybdenum wire, designed for grids in electronic power and receiving tubes, has been developed by Fansteel Metallurgical Corporation, North Chicago, Ill. Improved mechanical properties are obtained by controlled small amounts of a cobalt additive to a high-purity molybdenum base, resulting in minimized wire breakage on grid-winding machines and better stretch properties. Tests are said to have indicated no perceptible difference in electrical properties between this wire and pure molybdenum wire.

INGENIOUS *Mechanisms*

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Dual Gear Train Diminishes Backlash

By B. J. Popper, Kfar-Ata, Israel

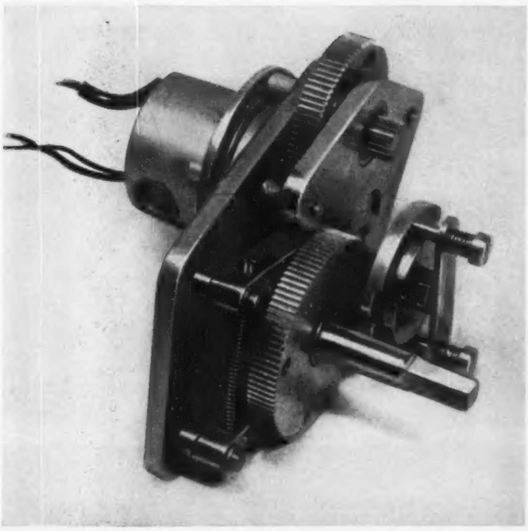


Fig. 1. Backlash in this servomechanism is eliminated by dual gear trains having different ratios.

Backlash in gears that function to amplify mechanical movements, as in servomechanisms, analog computers, and dial indicators, impedes the faithful reproduction of such movements. The mechanism here described involves a dual gear train that greatly minimizes the amount of backlash in a servomechanism.

In this particular instance, motion has to be transmitted with a ratio of 160:1. Backlash permissible for the slower pinion must not exceed 0.0025 degree. This accuracy is particularly important when the mechanism is in motion. To date the servo, shown in Fig. 1, has worked for over one thousand hours and has exhibited a backlash inaccuracy too small to be measured by any available means.

A diagrammatic representation of the dual gear train principle appears in Fig. 2. The line of transmission from driving gear *A* to driven gear *B* extends both through intermediate gears *C* and *D* and through intermediate gears *E* and *F*. Through gears *C* and *D*, the ratio is 160:1, as required; but through gears *E* and *F*, the ratio is stepped up to 190:1.

For all practical purposes, gears *C* and *D* may be considered as a single compound gear. Gears

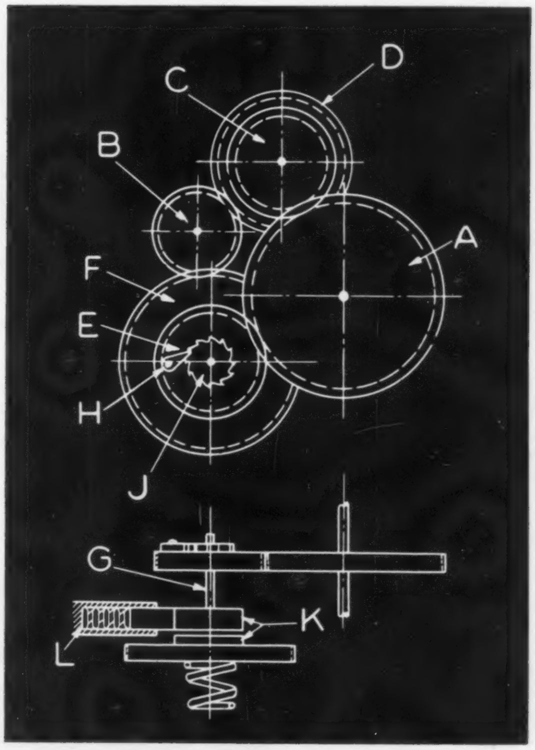


Fig. 2. Intentional slippage in the friction coupling (K) compensates for the differences in the ratios of the two gear trains.

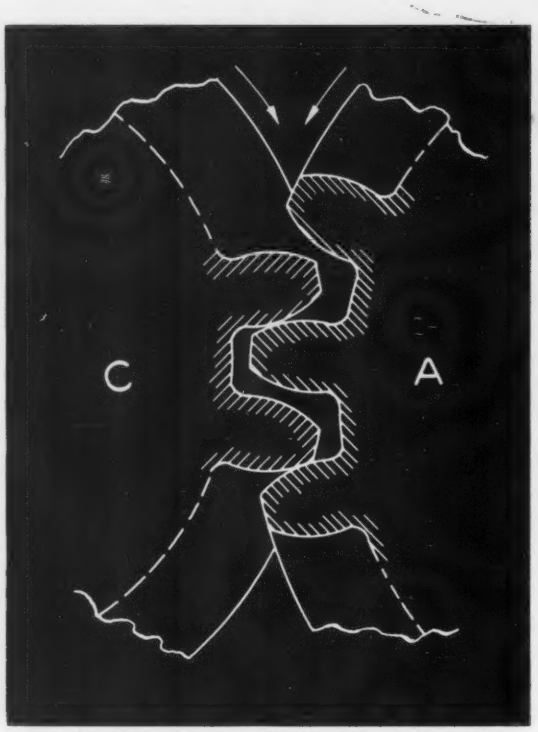


Fig. 3. When gear (A) rotates counterclockwise, the tooth-flank contact with gear (C) is as shown.

E and *F*, on the other hand, are entirely separate. Gear *E*, free on shaft *G*, carries a pawl *H*. This pawl, in conjunction with a ratchet *J* pinned to the shaft, represents a one-direction clutch. On the other end of the shaft is a friction coupling *K* through which the drive is transmitted to gear *F*.

When the driving gear *A* rotates counterclockwise, gears *E* and *F* attempt to rotate the driven gear *B* at a 190:1 ratio. However, since the actual speed of gear *B* is restricted by gears *C* and *D* to a 160:1 ratio with gear *A*, two things happen. First, a certain amount of slippage occurs in the friction coupling. Secondly, gear *C* tends to "drive" gear *A*, so that the tooth-flank contact between them is as illustrated in Fig. 3. Similarly, gear *B* tends to "drive" gear *D*.

Then, when gear *A* rotates clockwise, the drive is through the compound gears, and theoretically, no backlash has to be absorbed. Gears *E* and *F* will rotate by reason of their engagement with gears *A* and *B*, respectively, but the one-direction clutch prevents motion from being transmitted.

Since, during the original counterclockwise rotation of gear *A*, gear *F* drove gear *B*, no backlash exists between gears *F* and *B* when the rotation is reversed and gear *B* becomes the driver of gear *F* which now idles.

Also, the mild drag of a brake *L*, Fig. 2, on shaft *G* prevents gear *C* from running ahead of gear *A* when the latter is rotating clockwise. Since the brake exerts pressure on the shaft at all times, the friction moment of the brake must be stronger than the remaining moment trans-

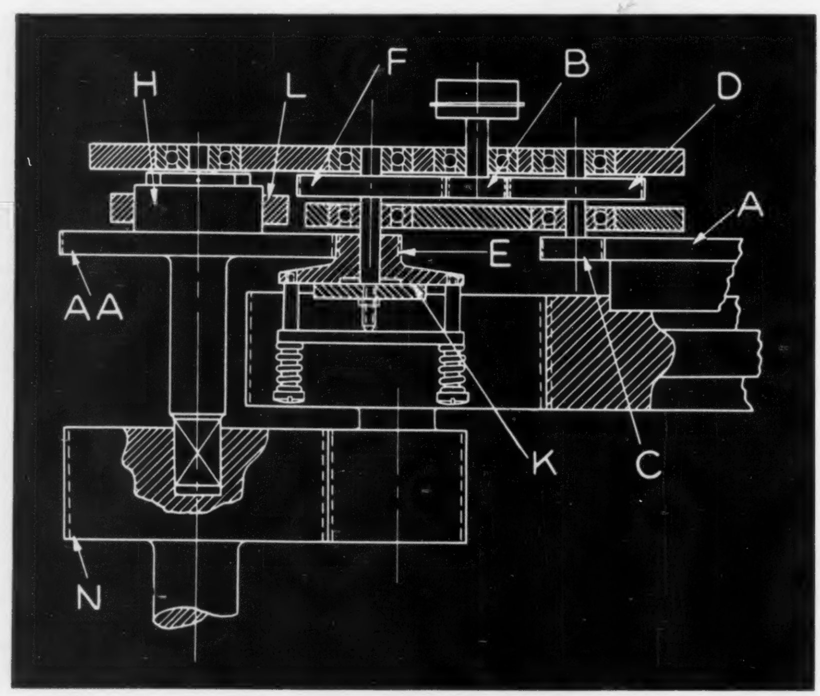


Fig. 4. Cross-sectional view of the servomechanism illustrated in Fig. 1, and built around the principle in Fig. 2.

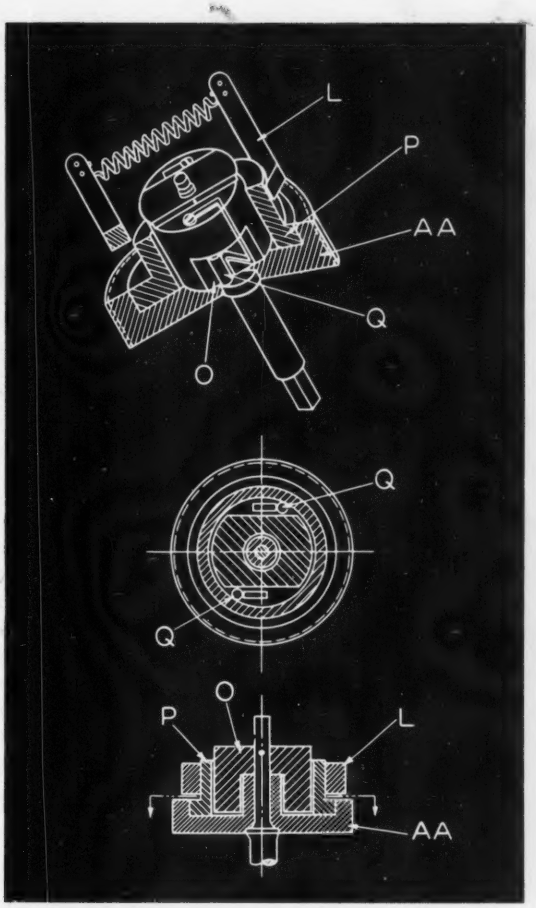


Fig. 5. Rollers (Q) serve to transmit motion between drum (O) and sleeve (P) in one direction only.

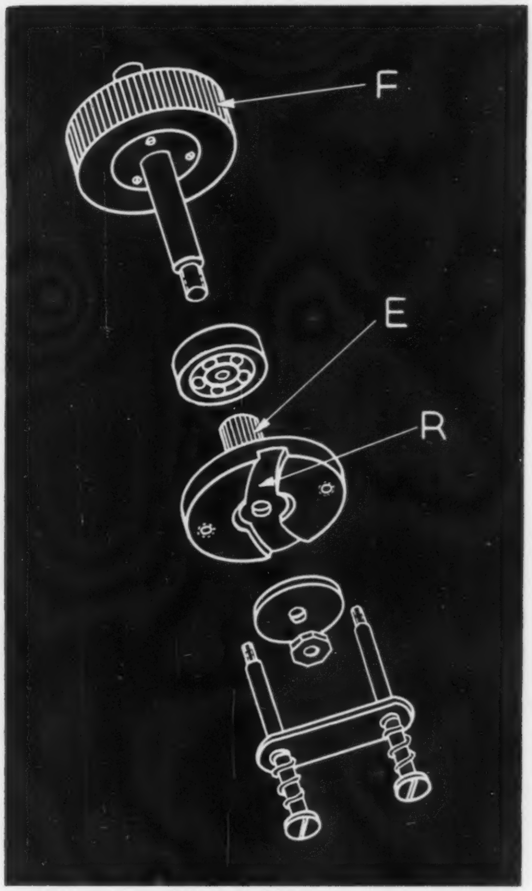


Fig. 6. Exploded view shows the friction coupling between gears (E) and (F).

mitted by the one-direction clutch when rotating in its free direction. In order to attain the greatest accuracy in the mechanism, the friction moment of the brake should correspond to the following equation:

$$M_{br} + M_{set} - M_{odc} = M_{coup} - M_{set}$$

where,

M_{br} = friction moment of brake

M_{set} = moment needed to rotate output shaft and overcome friction in mechanism

M_{odc} = remaining moment of one-direction clutch in free direction

M_{coup} = moment transmitted by coupling

(All of these moments have to be measured on the same axis.)

By thus maintaining a pressure between the teeth of the gears that is equal in both directions, the moment of the mechanism is assured of being constant. This, incidentally, is a feature not found in spring type backlash eliminators.

The actual mechanism that was built is shown in cross section in Fig. 4. Identifying letters on the drawing correspond to those for the counterparts in the diagrammatic representation, Fig. 2. In arranging the transmission, it was found practical to include two driving gears, *A* and *AA*. Both are powered by the same motor pinion *N*. From gear *A* to gear *B*, the train runs through gears *C* and *D*. And from gear *AA* to gear *B*, the train runs through gears *E* and *F*.

The one-direction clutch *H*, the brake *L*, and the friction coupling *K* function as previously described. Details of the clutch and brake appear in Fig. 5. The clutch consists of a drum *O* and sleeve *P*. A pair of rollers *Q* transmit motion in but one direction.

An exploded view of the friction coupling is shown in Fig. 6. Although the relative motion between the two discs of the coupling is small, together they revolve rapidly. A groove *R* in the larger disc produces a flow of air that serves to cool the coupling.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Combined Single- and Double-Action Die Produces Two Shells in One Operation

By Burnett Menkin, Larchmont, N. Y.

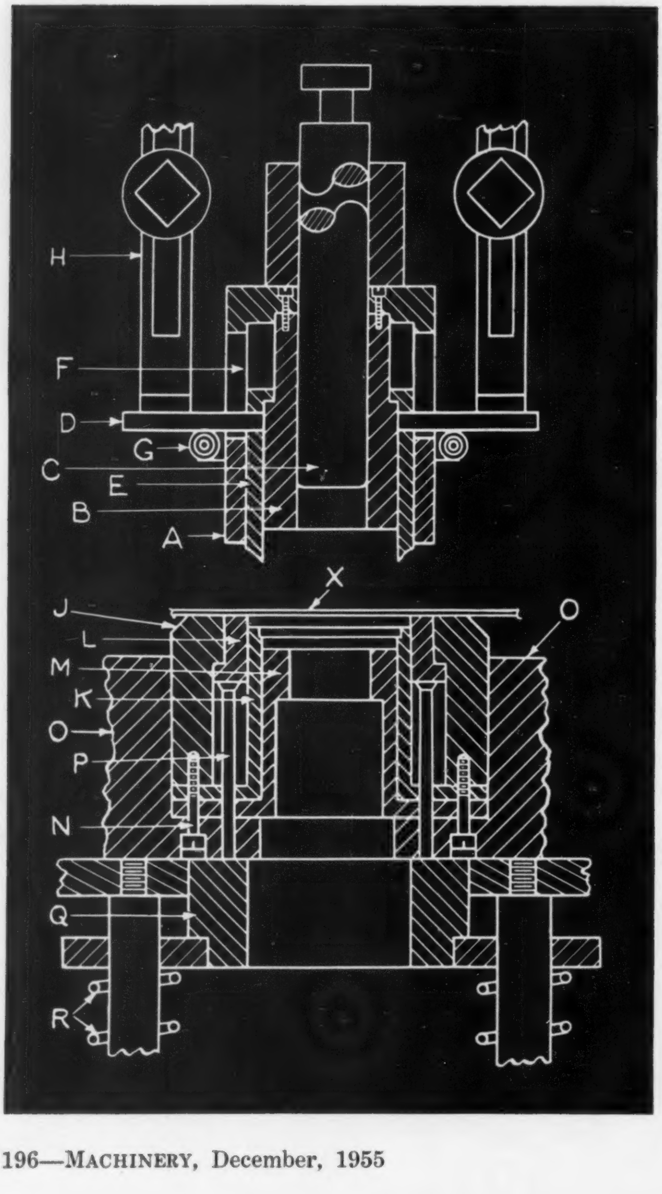


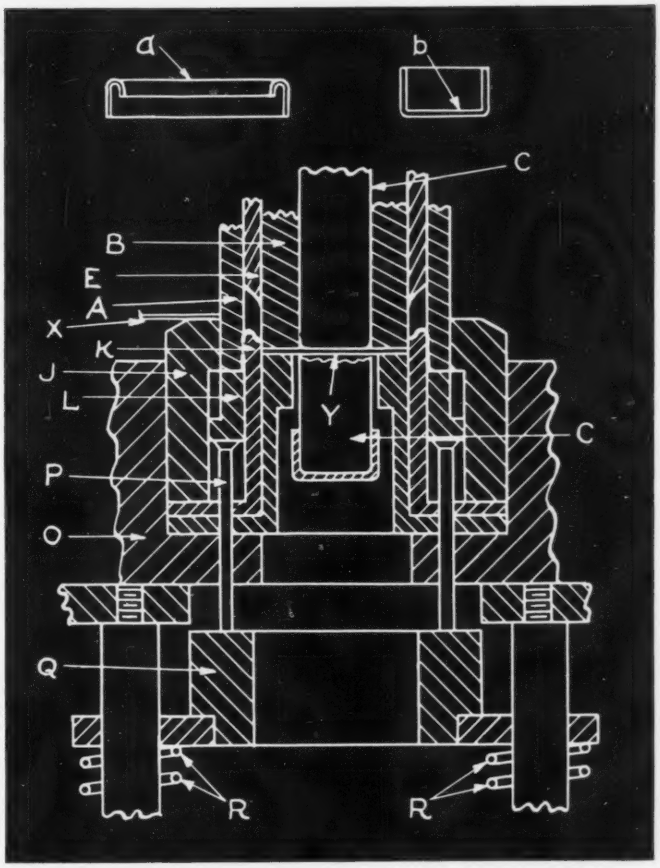
Fig. 1. Combined single- and double-action die produces a rim shell from excess stock in the process of forming a drawn shell

Rim and drawn shells of the design seen at *a* and *b*, Fig. 2, are produced in one operation from the same strip of stock by using a combined single- and double-action die mounted on a double-action power press. Sorting is eliminated since the two types of shells are ejected from the die separately at the rate of 240 pieces a minute. The construction of this die is shown in Fig. 1. The press is equipped with an automatic reel type feeding device.

The top cross-section in Fig. 1 shows a single-action blanking and drawing rim punch *A* secured by countersunk screws to a double-action punch sleeve *B*. A plunger *C* that draws shell *b* is a sliding fit in sleeve *B*. Rods *D* are screwed into the rim ejector sleeve *E* and move freely in slots *F*. Coil spring *G* (under the rods) encircles sleeve *A* and provides the tension necessary to support the ejector sleeve. Brackets *H* are adjustable to required heights above the rods to function in ejecting the finished rim shell.

The rim drawing ring *L* in the lower cross-section has a sliding fit between blank cutter *J* and the rim-lip shaping sleeve *K*. The shell drawing sleeve *M* is aligned with the punch sleeve *B*. Sufficient clearance is provided between the two sleeves to facilitate drawing shell *b*. Screws

Fig. 2. Both rim and drawn shells are automatically ejected separately, eliminating the need for sorting them



N secure the stationary parts *J*, *K*, and *M* to die base *O*.

The moving assembly upon which rim drawing ring *L* rides consists of pins *P* attached to a buffer *Q* which is supported by compression springs *R* and reacts downward during the drawing of rim *a*.

In operation, see Fig. 2, the stock *X* is blanked by punch *A* as it passes the upper edge of cutter *J*, the blank being supported by member *L*. At this time, because of the outward movement of punch *A*, ring *L* is depressed, thus compressing springs *R* through the pins *P* and buffer *Q*. Immediately, the lip of the rim shell is formed by sleeve *K*.

As the ram of the press descends, the double-action punch *B* shears the lip end of rim *a* and forms the shell blank *Y*. With the continued descent of plunger *C*, blank *Y* is drawn through sleeve *M* (Fig. 1) to form the shell *b*. On the upward stroke of the plunger *C*, the shell is stripped off the punch by a shoulder on member *M* and drops into a receptacle. Rim *a* is ejected at the same time by ejector *E* when rods *D* contact brackets *H*, Fig. 1. The rim shells are deposited in a box by an air blast coordinated with the operation of the press ram.

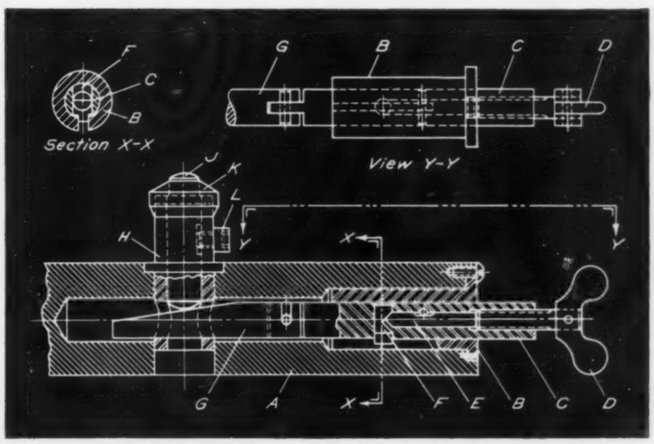
Plunger *C*, Fig. 2, is shown in two descending positions. It is regulated and timed so that it will draw shell *b* after punch *B* has sheared rim *a* and moved blank *Y* into position.

Adjustable Stock Support

By F. C. Elmo, Dayton, Ohio

When designing a work-holding fixture, it is necessary to provide support for the bottom surface of the casting or plate stock to be machined. An adjustable support is advisable so that it can always be seated snugly against the rough work surface.

An effective support of the adjustable type is illustrated. This unit is built into the fixture, *A* being a sec-



Adjustable support for work-piece is built into fixture. Support plunger (J) can be raised or lowered, then locked in place, by two-directional movement of thumb-screw (D).

tion of the fixture body into which a long blind hole has been drilled and counterbored. A flanged bushing *B* is screwed and pinned in the counterbore.

Wedge extension *C* is a sliding fit within the bushing. A thumb-screw *D* is threaded in the end of the wedge extension, bearing against the end of pointed pin *E*. The pointed end of pin *E* enters a matching recess in the side of lock-pin *F*, which is free to slide in a hole drilled diametrically through extension *C*. This sub-assembly is prevented from turning by a tongue on the end of pin *F* that extends into a slot in the wall of the flanged bushing, section X-X.

A tongue on the left-hand end of the wedge extension carries a pin that engages with grooves machined in the forked end of wedge *G*. The tapered end of the wedge passes through a hole cross-drilled in plunger support *H*.

Plunger *J* is rounded at both ends, the lower end riding on the inclined surface of the wedge, and the upper end bearing against the work-piece to be supported. To prevent chips from entering the plunger and wedge assembly, cap *K* is provided.

To raise the plunger of this stock support into contact with the work, thumb-screw *D* is pushed in, but not rotated. Both the wedge and the wedge extension are thereby forced to the left. Plunger *J* rides up on the wedge surface until it contacts the work, or until it reaches the height required to accommodate the part to be supported.

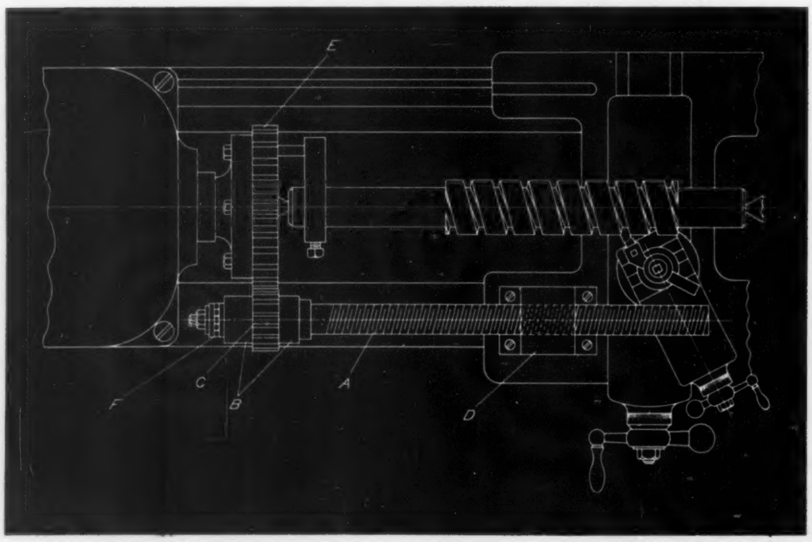
The thumb-screw is then rotated to force pin *E* into the conical recess in the side of lock-pin *F*. Because the center of the conical recess is slightly below the center of pin *E*, the lock-pin is compelled to rise, jamming against the inner surface of bushing *B* and locking the assembly in position. To retract the plunger, this procedure is reversed. In the event that it becomes necessary to prevent any movement of the plunger, socket-head screw *L* can be tightened.

Attachment for Cutting a Screw with Coarse Lead

By H. J. Gerber, Stillwater, Okla.

The cutting of coarse leads on a conventional engine lathe not equipped with a suitable lead attachment is sometimes a perplexing problem. The simple shop-built attachment here illustrated was designed and built to cut a small quantity of special carrier screws for printing machinery. These screws were to be of 1 inch pitch, and the largest lead that could be cut on the only available engine lathe was 1/4 inch.

In the construction of the device, a special lead screw *A* of 1/4 inch pitch, left-hand Acme threads is used. Bracket *B*, bolted to the lathe bed near the headstock, supports the lead screw and a twenty-tooth pinion *C*, of 10 diametral pitch, to which it is keyed. Nut *D*, threaded to fit screw *A*, is secured to the carriage saddle. Drive gear *E* has eighty teeth and is screwed and doweled to a special adapter plate secured to the lathe spindle nose. The end thrust of the lead screw is taken by ball bearing *F*.



Attachment designed for cutting coarse leads on a lathe originally built for cutting leads up to 1/4 inch only

In operation the two mating gears and special lead screw substitute for the normal lead screw and its connecting gear train. The carriage is completely disconnected from its normal feeding mechanism and is carried along the work by the substitute lead screw. Although the lathe must be reversed in rotation to return the tool to its starting point after each cut, the action is rapid due to the coarse pitch involved. A pin type dog, tightened to the work-piece and having its tail set in a hole in the drive gear, turns the work between centers.

Construction of the attachment should be massive to permit heavy cuts and to allow no perceptible deflection. In this particular case, the screw and pinion are mounted quite high on the lathe bed so the free end of the lead screw would clear the cross-slide and compound.

Right-Angle Indexing Head for Horizontal Boring Mill

By Dwight D. Wells, Hamilton, Ohio

Bed plate and gib rail pads for steel press frames are face-milled on a horizontal boring, drilling, and milling machine with the attachment illustrated. This device converts the drive 90 degrees, permitting the work to be clamped directly on the machine table. An integral indexing feature enables the cutter to operate at four different points in the vertical plane.

Section and end views are shown in the accompanying illustration. A mounting plate *A* is doweled and screwed over the end of the machine spindle *K*. This plate is fitted with a stationary indexing ring *B* in which are four holes *C*, radially spaced 90 degrees apart. The indexing head *D* is supported on needle bearings *E* over a sleeve *F* press-fitted to, and extending from, the bore of the indexing ring.

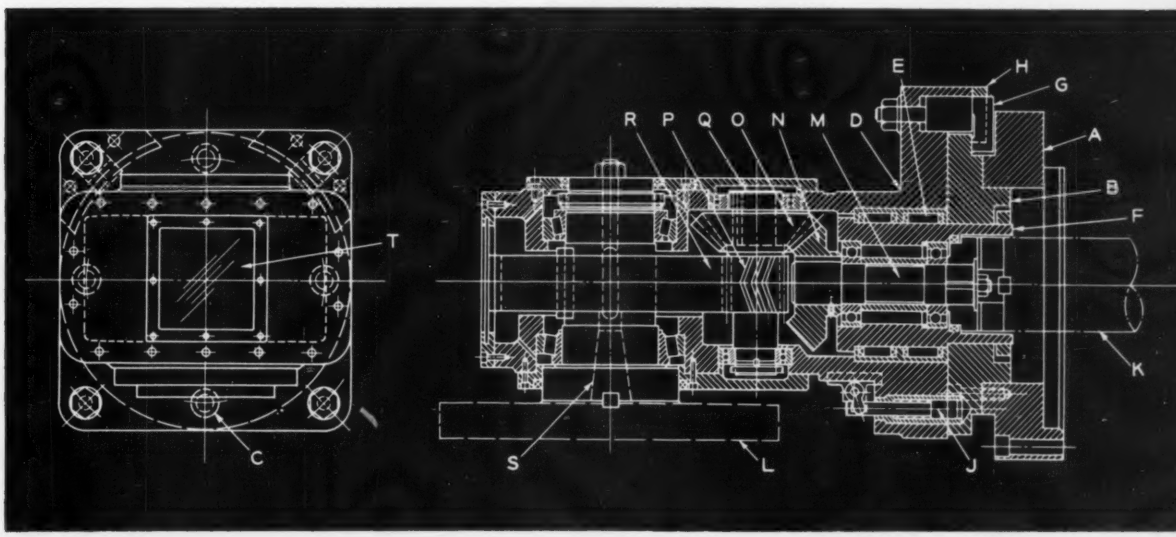
Hook-bolt clamps *G* and retainers *H* secure the head with a shoulder on the back of the indexing ring. In the head is a cam-operated locating pin *J* which can be engaged with any of the four holes in the ring after the head has been rotated to the desired position.

From the machine spindle *K* the line of transmission to the face-milling cutter *L* is through a ball-bearing drive shaft *M*, bevel gears *N* and *O*, and pinion *P* on jack shaft *Q* to gear *R*. This gear encloses the attachment spindle *S*, which is mounted on roller bearings. Seals on the spindle and drive shaft prevent oil leakage. An inspection window *T* is provided at the end of the head.

* * *

The United States is the largest consumer of zinc in the world. Though we have only 7 per cent of the world's population, we use 40 per cent of the world's primary zinc—at the rate of 11.4 pounds per capita. Per capita use in the United Kingdom is 7.6 pounds and in France, 6.2 pounds.

The head transmits the horizontal drive of the machine spindle (K) to the vertical plane of the face-milling cutter (L).



Ideas for Shop and Drafting-Room

Measuring Wall Thicknesses with a Micrometer

By George G. Herzl, Philadelphia, Pa.

Steel balls or wires can be used in combination with a micrometer for measuring the wall thicknesses of tubing and other hollow cylinders. In this practice a ball is placed on the inner surface of the tube, as shown at A in the illustration. Both the wall thickness of the tube and the diameter y of the ball are then measured with a micrometer to obtain dimension m. The thickness x of the tubing wall is found by subtracting y from m.

Hole-to-hole distances in many parts may be similarly found by measuring over two balls, or wires, and the intervening wall with a standard micrometer as shown at B. In finding the distance x between holes, the sum of the two ball diameters (designated y) is subtracted from the micrometer measurement m.

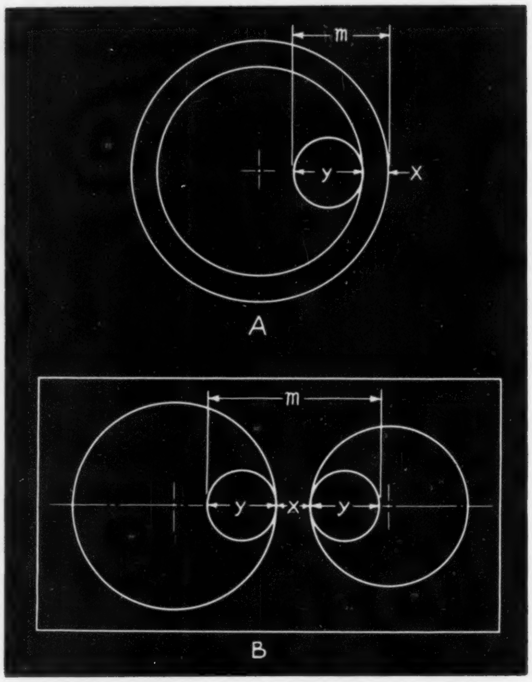
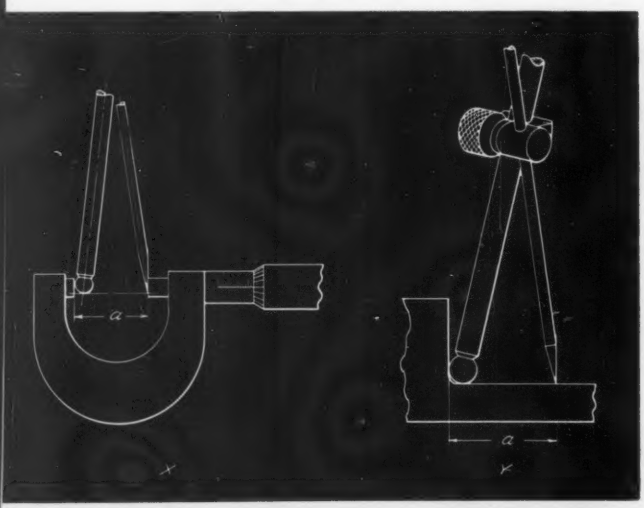


Diagram illustrating methods for measuring wall thicknesses with steel balls or wire

Scribing Lay-Out Line from a Rounded Corner

By Richard M. Weber, San Francisco, Calif.

A lay-out line located from a corner containing a fillet may be quickly and accurately scribed by the method illustrated. All that is needed is the ball-end column of a surface gage with its attached scriber, and a micrometer.



Ball-end column and scriber member of a surface gage are used to mark lay-out line located from a rounded corner.

Merely set the micrometer for the required dimension a and lock it in position. Then place the ball-end of the column and the point of the scriber between the anvil and spindle of the micrometer, as shown at X, and adjust them to correspond with the desired setting. This setting may be transferred to the work-piece as illustrated at Y. The work will contact the column end at the same point as did the micrometer anvil. Therefore, when this end and the point of the scriber are held at right angles to the vertical leg of the part, the lay-out line may be accurately marked. One point must not be overlooked—the radius of the ball must be greater than the radius of the fillet.

* * *

Skilled Employes in Labor-Sharing Plan

A unique labor-sharing plan is providing Ryan Aeronautical Co. with highly skilled personnel during its peak tooling program. Four aircraft plants in various parts of the country have lent Ryan 120 tool designers and jig and fixture builders for several weeks' temporary duty at the Ryan factory in San Diego, Calif.

Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Manpower — An Ever-Present Problem

THE average sales manager is alert to the necessity for directing sales effort toward prospects and customers to replace equipment and processes that are obsolescent or can be improved. On the other hand, too frequently sales managers are inattentive to this same condition as it applies to their own sales organization which consists of men instead of machines.

One sales manager suddenly realized that the average age of his sales force was far too high. Another, faced with a proposed expansion of his products by top management, found himself unprepared with sufficient manpower to meet the enlarged sales program.

Management is inclined to schedule programs for manufacturing changes more readily than those involving manpower. Bricks, steel, and machines can be created and assembled faster than sales engineers can be selected and trained. Beyond this, sight is often lost of the inroads that time makes upon any active group of men. Sales managers get involved in everyday pressing problems. They often unconsciously avoid the necessity for evaluating sales personnel in relation to future needs. Time wears away any sales organization. Long-term needs, with regard to replacements and expansion, are usually neglected.

In shaping a program for manpower development, the sales manager should select a period of time, such as five or ten years, and calculate the losses that have occurred in his sales personnel during that interval. Advancing age, retirement, separation, and incapacity represent a definite total loss that can be accurately calculated. Just to maintain a present organization it is necessary to plan for such losses.

The additional men needed during the next five years should be estimated. The sales manager should ask himself: "What will be the normal expected customer demand due to industrial growth? What new products will the company have for sale? What new industry or territory should be served?" By calculating the potential impairment of any sales organization and expansion needs, an annual quantitative measure can be determined to meet future requirements.

An important factor in considering manpower requirements is the length of time needed to train sales engineers. Two to six weeks may suffice to train a merchandising salesman, but months and years are required to develop a capable sales engineer. Experience in areas of manufacture, engineering application, order processing, and service are all functional activities the sales engineer should understand. It must be remembered, too, that men are lost during the process of training, just as in the case of experienced sales engineers. It is well to have a small reservoir of young men available, even though the exact future place for each man is not certain.

Another matter that sales managers sometimes neglect is the change that will take place in territorial markets. One sales manager of an eastern concern failed to grasp early enough the expanding market for his product in the south and southwest. His manpower plans had not included developing talents suitable to sell in these areas. Still another sales manager has repeatedly met periods of embarrassment because he did not have "runners-up" for important sales personnel. Often a sales engineer is hindered from advancement for the reason that no one is ready to take his place.

A study of each man in relation to his present and future responsibilities is essential. Sales management's success depends first on defining the sales job, carefully selecting the proper man, and then continually evaluating his performance.

The sales manager directing the marketing of industrial equipment ranks at the top in the selling fraternity. Technical selling calls for much more than marketing skill. The capacity to solve problems of organization and personnel will mark the sales manager of the future.

LATEST DEVELOPMENTS IN *Shop*

Burr-Master Automatic Deburring Machines for Internal and External Gears

Automation for its Burr-Master gear deburring and chamfering machines is announced by the Modern Industrial Engineering Co., Detroit, Mich. This equipment does large-volume deburring and chamfering of internal and external gears and splines. Now, automation is available on the BME-24, two-station external and the BMI-15, single-station internal machines, Figs. 1 and 2. Each maintains a deburring and chamfering rate of five teeth per second. It is possible to change from one gear size to another with relatively minor tooling changes, keeping the basic automation equipment intact.

The equipment requires no operator attention. Actual production rate depends on the number of gear teeth. An example is a thirty-tooth external gear which can be deburred and chamfered on both sides at a rate of 300 pieces per hour. Automated machines can be supplied to handle gears with pitch diameters from 5/8 to 6 1/2 inches for external gears, and 2 to 20 inches for internal gears.

Operation of the external machine is as follows: With the selector switch in "automatic" position, a disc picks up one gear at a time and permits it to slide forward into the loading station. The part moves along to the first work-station, where an elevator positions it on the work-spindle.

After one side of the gear is deburred and chamfered, the elevator transfers it by a chain conveyor to a turnover station, where it is rolled over 180 degrees. Deburring and chamfering of the second side then proceeds. If loading storage space ahead of the machine is empty, or unloading space leading from the machine is full

Fig. 1. Automated two-station Burr-Master for deburring and chamfering external gears

Fig. 2. Single-station Burr-Master equipped to deburr and chamfer internal gears

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

and cannot accept additional gears, remotely located switches stop the cycle. Also, a timing relay indicates a prolonged cycle by stopping the machine, and a red signal light is turned on.

During a typical automatic cycle of Model BMI-15, the movement of the loading cylinder rotates a loading disc and permits one part to pass through at a time into the transfer line. The gear moves by elevator to central position above the work-station. At the same time, a completed gear is ejected into an exit chute.

As the transfer cylinder returns, the quill moves downward and the gear contacts a radial gaging pinion. Since this pinion turns in timed relation to a spline driver mounted on the spindle, the interaction assures that the driver will enter the teeth of the internal gear. The quill continues its movement, carrying the gear down into the work-station and starting the chamfering cycle by tripping a limit switch. After the work has made one complete revolution and all teeth are deburred and chamfered, the reciprocating form cutter stops in the retracted position, and the part is raised from the work-station to complete the cycle.

A coolant system is provided to flush chips out of the work area although it is not necessary for the actual operations. Circular form tools are used.

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Fig. 3. Rear view of two-station external gear deburring machine showing automation equipment

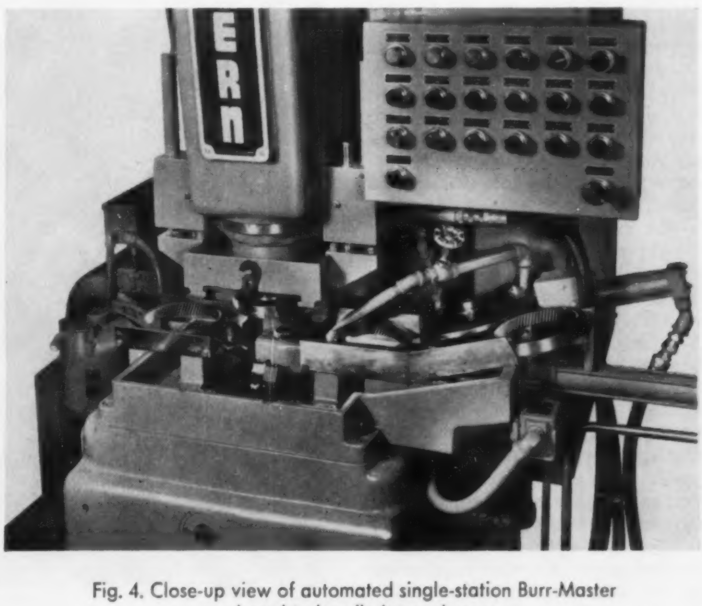

Fig. 4. Close-up view of automated single-station Burr-Master equipped to handle internal gears

Alloy Fluxes for Automatic Submerged-Arc Welding

The Lincoln Electric Co., Cleveland, Ohio, has introduced a line of agglomerated fluxes for automatic submerged-arc welding of low-alloy steels. This development provides a new approach to the problem of welding complex and

highly specialized steels, and is said to be both economical and flexible in meeting the wide range of special requirements for welding these steels. The alloy flux is individually compounded for each job. These special fluxes, through a process of agglomeration, are given alloying elements which may be changed as required by the particular job for which the flux is made. They can be used with a mild steel electrode.

The fluxes available can be compounded to produce weld metal containing the following elements in varying amounts: chromium, molybdenum, vanadium, and nickel. They can be used for welding the steels classified as low-alloys, which are generally accepted as steels containing less than 6 per cent alloy. Applications would include welding chromium-molybdenum pipe for high-temperature service; steels such as ASTM specification A335-53; alloys P-2, P-3, P-3b, P-11, P-12, P-21, and P-22; also Grades A and B of specification A301-53.

The fluxes are used on the newer highly complex high-strength alloy steels and armor steels. They can be employed to produce an alloy deposit that will respond to heat-treatment in order to produce the same hardness or tensile strength as the heat-treated plate. Another application is the addition of alloys to the weld through the flux when additional alloy is needed to control dilution.

Adding alloys to the weld deposit through the flux rather than through the wire is said to have several advantages. The agglomeration process of manufacturing the fluxes permits precise control of the compounded fluxes to meet the requirements of a weld deposit.

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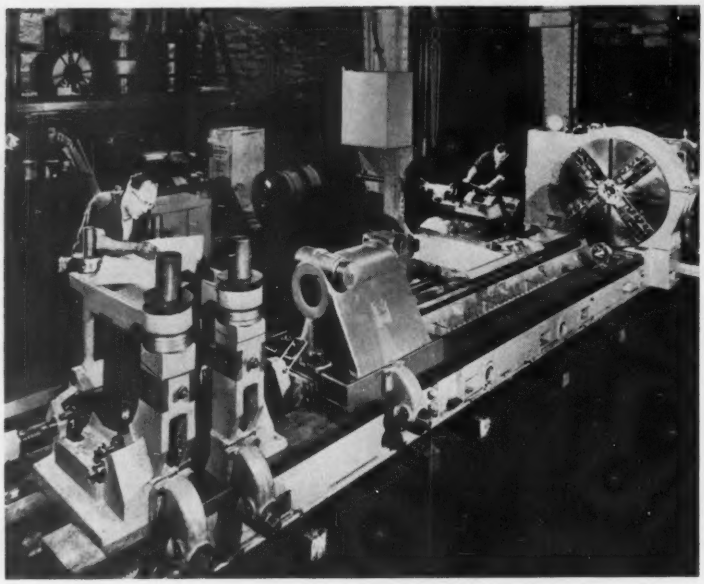

Fig. 1. Mackintosh-Hemphill duplicating roll lathe swings work 48 inches in diameter

Electrically Controlled Roll Lathe for Contour Turning

Heavy-duty lathes for the rapid finishing and redressing of mill rolls and similar work requiring accurate duplication of contours have been built by the Mackintosh-Hemphill Division of E. W. Bliss Co., Pittsburgh, Pa. The first lathe of this group, Fig. 1, can handle work with a maximum collar diameter of 48 inches and an over-all length up to 18 feet.

Through dual-motion control from a stylus following a flat master template, the cutting tool of this machine accurately reproduces the desired contours in structural-shape mill rolls. Roughing is done with carbide tools at speeds up to 62 R.P.M., and finishing, with high-speed broad-nose tools, at roll speeds of less than 1 R.P.M.

Electronic equipment for the dual duplicator of the lathe was supplied by Raytheon, Inc., Waltham, Mass., and the 100-H.P. headstock drive motor and controls were built by the General Electric Co. Chips are removed by means of a reciprocating conveyor.

The electronically controlled contour-turning lathe, Fig. 2, shapes rolls with outside diameters up to 50 inches and lengths up to 18 feet. This lathe is fully automatic in operation. Its carbide cutting tool is moved by inde-

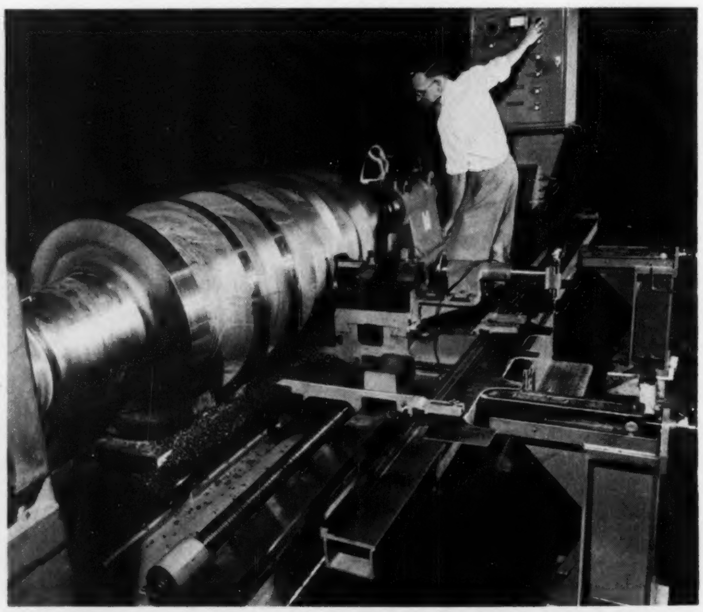

Fig. 2. Operator directs movements of lathe from control panel

pendent long-feed and cross-feed motors duplicating on the roll body the contour of a full-sized template with which the stylus makes contact. The control provided by this arrangement is so precise that an accuracy of 0.001 inch can be obtained. Smooth cuts can be made on a shoulder normal to the axis of the roll. This lathe operates at a maximum cutting depth of 7/8 inch and feeds of 0.060 to 0.100 inch.

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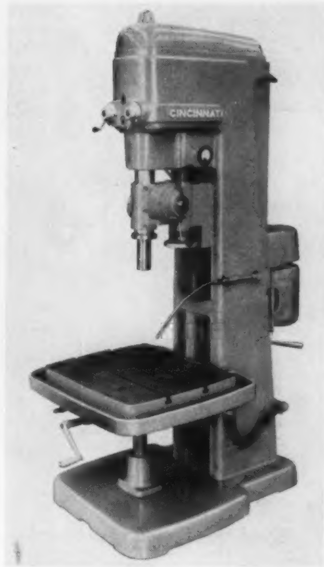

Sliding-head, floor type drilling machine introduced by the Cincinnati Lathe & Tool Co.

Ex-Cell-O Precision Cylinder-Block Boring and Processing Machines for Automation Lines

The precision cylinder-block boring and processing machines assembled in the unit shown in the accompanying illustration are representative of equipment built by the Ex-Cell-O Corporation, Detroit, Mich., for automation setups in automobile manufacturing plants. This application provides for six different machining operations on a typical V-eight engine block. In sequence these operations are: semi-finish-bore cylinders; chamfer cylinder tops; chamfer cylinder bottoms; semi-finish-bore four tappet holes; chamfer four tappet holes; and finish-bore four tappet holes.

Locating dowels serve to position the cylinder block, which is held firmly in place against locator buttons by hydraulic yoke clamps. A pattern of alternate boring is followed to permit the use of large diameter, heavy-duty spindles in boring the closely spaced holes. These heavier spindles insure rigidity and absorb the shock encountèred in multiple-spindle operations, thus delivering accurate work and eliminating wasteful down time for repairs and stopping of the production line. Subassemblies are made readily accessible; electrical circuits are easily traced; and hydraulic systems are designed to require little attention, thus simplifying servicing and meeting automation requirements.

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Precision cylinder-block processing unit built by the Ex-Cell-O Corporation to meet automation requirements

Cincinnati Sliding-Head Drilling Machines

Sliding-head, floor type drilling machines that will drill to the center of a circle 21 inches in diameter were featured at the Chicago Machine Tool Show by the Cincinnati Lathe & Tool Co., Cincinnati, Ohio. These lathes are available with a box or round column. The box column machines are also offered with multiple spindles.

Every important element of the new drilling machines is built in and conveniently located for operator comfort and to present a pleasing appearance. The machines are shipped complete with motor and controls to eliminate installation delays. They are ready to operate as soon as power leads are connected to the factory-installed, fully enclosed, built-in electrical panel. An interlock is built into the door of the panel to prevent opening it unless the disconnect switch is in the "Off" position. Another safety feature is a transformer supplied with all machines for operation on 220 volts or over to reduce voltage at the push-button station to 110 volts.

Geared power feed is furnished as standard equipment to facilitate drilling and to give higher production. A simple selector is used to obtain any of four rates of feed that are engaged through a positive-jaw clutch. The entire power-feed mechanism is built in and completely housed in the head. Drilling capacity is rated at 1 1/2 inches in cast iron with a 2- or 3-H.P. motor having a speed of 1800 or 1500 R.P.M. A No. 4 Morse taper spindle is standard equipment, a No. 3 Morse taper spindle being optional.

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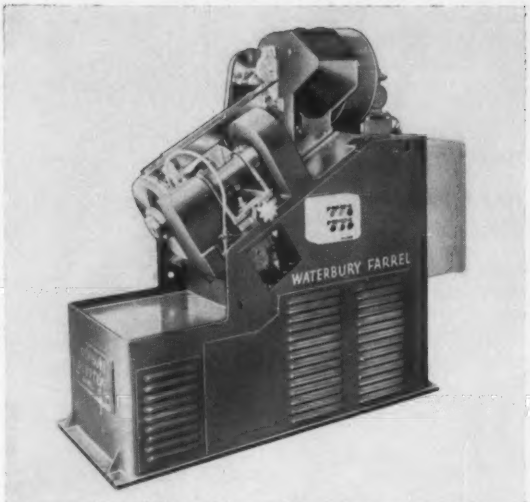

Screw-slotting machine built for rapid operation

Toolmaker's microscope offered by the George Scherr Co.

Waterbury Farrel Screw-Slotting Machine

A Model 5 screw-head slotting machine capable of delivering up to 51,840 burr-free slotted blanks per hour has been announced by the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. This machine slots standard or special-headed, ferrous, or non-ferrous blanks in sizes from No. 6 to 1/4 inch in diameter up to 2 1/2 inches long at variable speeds from 60 to 864 per minute. One dial, furnished as standard equipment, feeds all sizes of screws within the range of blank diameters given. For other blank diameters the machine can be equipped with special dials.

This screw-slotting machine has been designed for both long and short run work. Its simplicity and rapid set-up make it economical for short runs, while its high speed is a major advantage on long runs. The only tooling required is a saw and burr-remover blades made of spring steel.

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Precision Cross-Feed Screw and Ball-Bearing Ways for "Hydrabrasive" Grinders

All surface grinders in the "Hydrabrasive" line, manufactured by the Abrasive Machine Tool Co., East Providence, R. I., are now fitted with precision cross-feed screw and ball-bearing ways for the saddle to provide for smooth transverse adjustment. With this equipment, the machines are well suited for accurate slot grinding. A hydraulic drive provides quick-acting vibrationless operation of the table and saddle.

The ball bearings for the saddle ways roll in square, rather than V-shaped channels, eliminating table rocking and excessive wear, it is claimed. With the new design, the center line of the work never out-travels the full support of the saddle ways, thus eliminating overhang. The saddle feed-screw is precision-ground.

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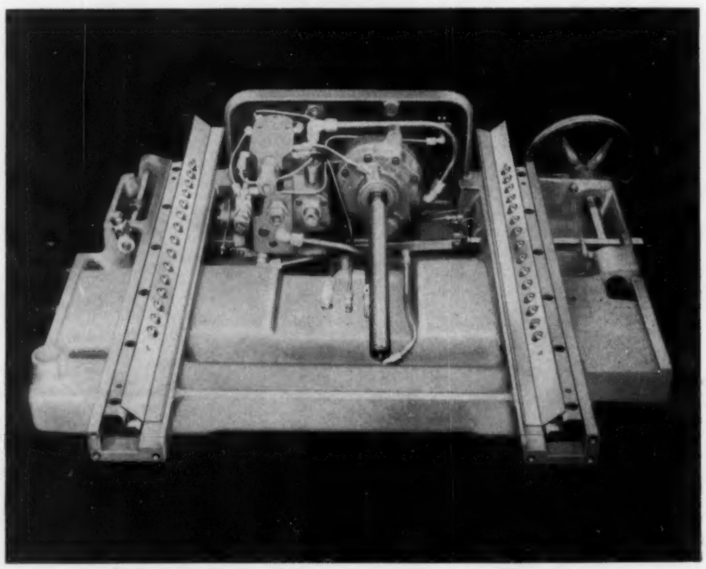
Toolmaker's Microscope

The George Scherr Co., New York City, is offering a complete line of toolmaker's microscopes, the smallest having a 1 1/2- by 2-inch range and the largest an 8- by 40-inch range. This model is a completely universal type toolmaker's microscope and is economically priced to permit a wide distribution among toolmakers. It permits precision measuring of coordinates to 0.0001 inch and angles to 1 minute of arc. Radii, concentric circles, screw threads, and similar elements can be measured.



Saddle for "Hydrabrasive" surface grinder

The stand is manufactured in New York, the optics being furnished by the firm of E. Leitz, Inc., Wetzlar (Western Zone) Germany. The measuring stage has a range of 1 1/2 by 2 inches with 1-inch micrometer drums reading in 0.0001 inch. Additional movement in both directions is obtained by the use of gage blocks.

Quick-change ocular heads are available for angular measurements to 1 minute of arc; for precision measuring of concentric circles; and checking threads.

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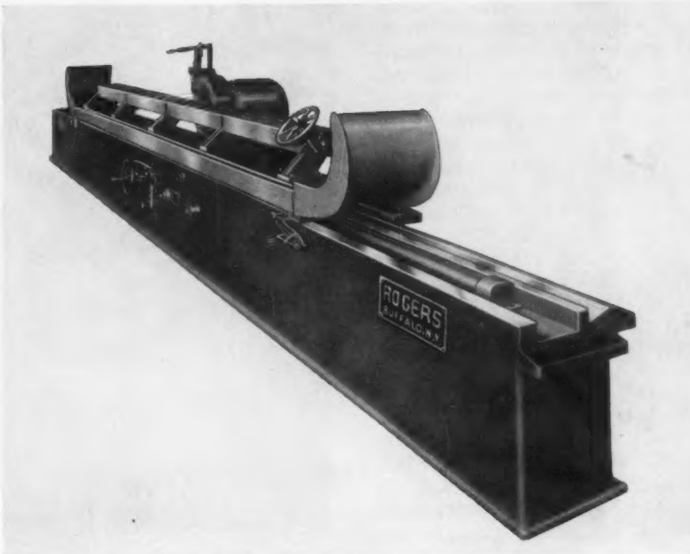

Knife and face grinder with hydraulic table drive, manufactured by Samuel C. Rogers & Co., Inc.

Rogers Cabinet Base Knife and Face Grinder

A Series 220 grinder being manufactured by Samuel C. Rogers & Co., Inc., Buffalo, N. Y., is of traveling table design for face and bevel grinding of shear blades, chipper and other straight knives, as well as for production face grinding of steel parts. A hydraulic drive provides table speeds from 10 to 100 feet per minute. The grinding wheel-head has a built-in motor with a ball-bearing spindle. The head is adjustable for flat or concave bevel grinding. A magnetic chuck of the swiveling type is available in all sizes. A mechanical knife bar or swiveling work-table can also be furnished. The equipment is available in lengths of 78 to 220 inches.

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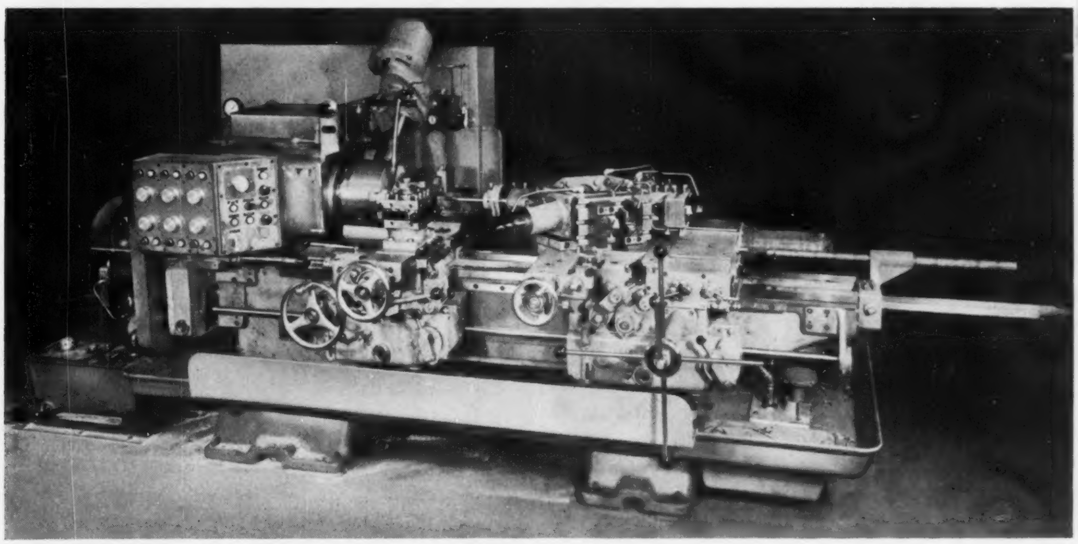
Jones & Lamson Universal Saddle Type Turret Lathe

A universal saddle type turret lathe with Hydra-clutch headstock, motor-indexed hexagon turret, and pre-selected automatically changed spindle speeds for each position of the hexagon turret has been introduced by the Jones & Lamson Machine Co., Springfield, Vt. The new headstock has thirty-two spindle speeds available in either direction of rotation in two ranges of sixteen speeds each. The spindle is driven by a 40-H.P. motor and the speeds within each range can be changed at any time without stopping the spindle by a pre-selector switch with push-button control. These changes are accomplished through solenoid valves which actuate hydraulically operated multiple-disc clutches.



Universal saddle type turret lathe brought out by the Jones & Lamson Machine Co.

Automatic speed selection and changing are provided for each face position of the hexagon turret by means of a secondary panel having six pre-selector switches. Speeds so obtained can also be changed by a master pre-selector switch and push-button.

All conventional headstock controls are actuated by a switch or push-button. These include controls for starting and stopping the motor, starting and stopping the spindle, spindle jogging, and controlling the direction of spindle rotation. High- and low-speed ranges and the free spindle position are manually selected by lever-operated sliding gears while the spindle is stopped.

Basic speeds available for the spindle with the 2 1/2-inch hole range from 30 to 527 R.P.M. in the low-speed group and from 89 to 1542 R.P.M. in the high-speed group. Six additional speed-range groups are available through the use of accessible change-gears which provide a total speed range of 18 to 2550 R.P.M. The spindle with the 4 1/2-inch hole has a basic low range of 20 to 341 R.P.M. and a high range of 58 to 998 R.P.M.

The hexagon turret is indexed, in one direction only, by a separate motor and Geneva mechanism.

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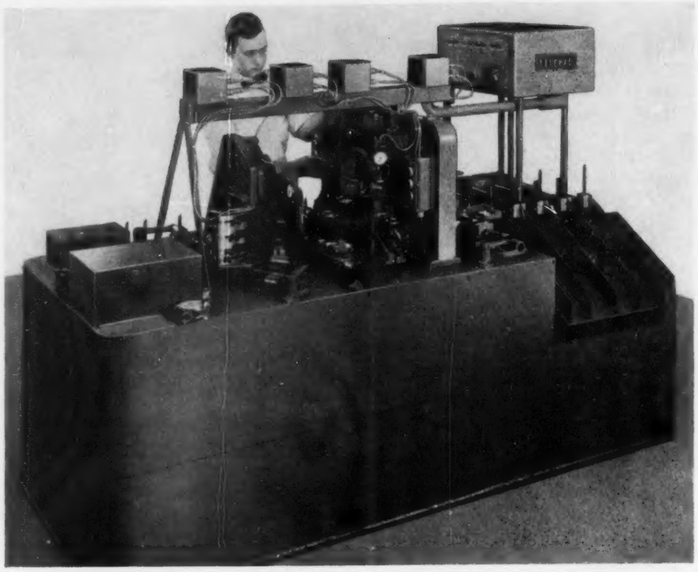


Fig. 1. Federal automatic gage for checking jet engine stator blades

Gage for Stator Blades, Air Gage Recorder for Sheet Material, and Parallelism Gage for Grinding Wheels

A fully automatic, four-station, in-process sorting gage, Model 144 B-34, Fig. 1, that measures twenty dimensions on thirteen different sizes of jet engine stator blades, 2 to 6 inches long, is announced by the Federal Products Corporation, Providence, R. I. Operating at any speed up to forty work-pieces per minute, this gage diverts rejected parts to a conveyor which leads to further processing stations.

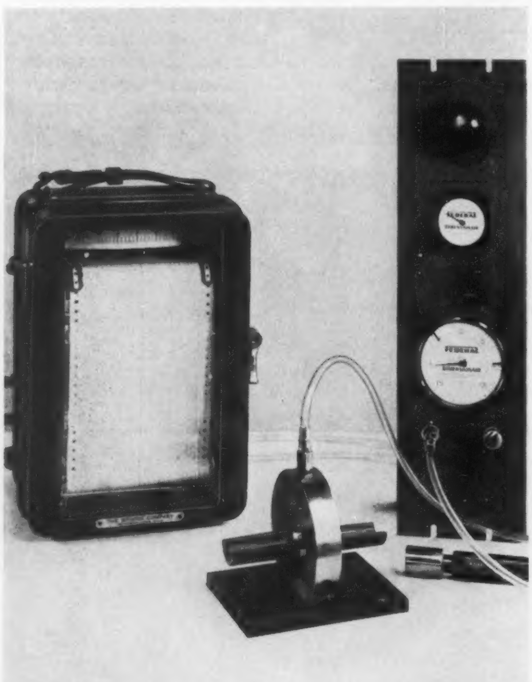


Fig. 2. Air gage recorder for strip or sheet material

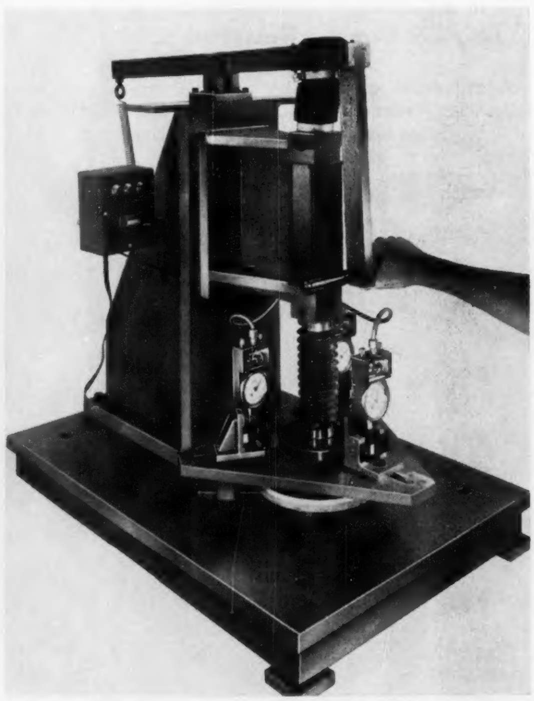


Fig. 3. Federal gage for checking grinding wheels

It is now possible to obtain a permanent record of air gage measurements through the use of a Dimensionair-Recorder, Fig. 2. A special gage head is used for the continuous measuring of sheet or strip material. The recorder chart provides both a permanent record and a constant visual check of the thickness of the material. The size trend is easily followed by observing the position of the line on the chart. When the chart shows a trend toward out-of-tolerance dimensions, corrective action can be taken before any scrap is actually produced. Or, if desired, automation can be used by applying other Federal units which will automatically adjust the machine so that it will produce material of the required thickness.

The gage shown in Fig. 3 is built for rapid, accurate, measurement of the parallelism on several sizes of grinding wheels which are to be used for precision work. Three Federal Electricator gaging units are used to do the measuring. These are connected to an electric power unit which operates signal lights. The green light signifies all OK but if any of the Electricators find an out-of-tolerance condition, other lights flash red for high spots and yellow for low spots. Grinding wheels in the 6- to 12-inch diameter size range and from 1/2 inch to 2 inches in thickness can be accommodated on the Model 256 B-70 gage shown in the illustration.

Circle Item 112 on postcard, page 231

Automation-Equipped "Shear-Speed" Gear Shapers

The Michigan Tool Co., Detroit, Mich., announces the availability of completely automatic operation of its 1800 series "Shear-Speed" gear shapers, including automatic size adjustment to assure continuous operation. The complete set-up includes automatic work-loading equipment, a washer for cleaning gears prior to inspection, and a three-way classifier and control panel for 100 per cent size inspection and control. Various combinations using one or more of these components can be supplied.

An automatic size-control unit, working in conjunction with the three-way classifier control panel, regulates the total infeed of the radial cutting tools. It acts to increase or decrease total infeed by means of electrical impulses fed back through the three-way gear classifier and control panel to the size controller, as over-size or under-size gears are detected.

When the tools become dulled to the extent that over-size gears are produced, the control panel shuts down the gear shaper. The automatic loader is mounted so that it swings to one side for tool changing. A magnetic chip separator removes chips automatically from the cleaning fluid in the gear washer. A clutch-brake unit installed in the drive system stops the work instantly, assuring precise positioning of the work-holding fixture for automatic loading. Existing machines can be modified for fully automatic operation.

Circle Item 113 on postcard, page 231

Automatic Internal Spline Broaching Machine

A 30-ton, pull-down broaching machine with a 60-inch stroke, built by the American Broach & Machine Co., Ann Arbor, Mich., automatically completes ten internal splines in an automobile brake-drum in one pass. The machine picks up parts from a conveyor line, transfers them to the broaching position, and after

Michigan "Shear-Speed" gear shaper equipped with automatic loader, washer, and gear classifier

Automatic broaching machine built by American Broach & Machine Co. for producing ten internal splines in one pass

broaching returns them to the conveyor line, all automatically. During the broaching and return strokes, a loading unit moves outward on guide rails, picks up another work-piece from the conveyor line, and returns ready to reload the work-fixture. The machine runs continuously on automatic cycle as long as parts are supplied by the conveyor line.

A separate oil tank is provided for the fixture which is hydraulically operated. An automatic chip conveyor unit disposes of chips. Tooling includes broach pullers with multiple springs and alignment pilots, a hardened and ground arbor that holds the ten broach assemblies, and high-speed steel, sectional, surface broach assemblies approximately 48 inches long.

Circle Item 114 on postcard, page 231

Cross Lathe for Machining Shells

A lathe designed for use in the production of 8-inch shells is the latest addition to the line of special machine tools built by The Cross Company, Detroit, Mich. This machine rough-turns the outside diameter, and finish-faces and chamfers the base end of the shells, producing twelve units per hour at an operating efficiency of 100 per cent. It incorporates seven overhead, individually controlled, contour-turning tools, and a tool for facing and chamfering the base.

Rough and semi-finish cutting are accomplished in one automatic cycle in sequence controlled from a centralized push-button station. The lathe has hydraulic feed and rapid traverse, hydraulic power-operated tailstock, and hydraulic work-clamping.

Pre-set tooling, 150-H.P. motor for the spindle drive, J.I.C. standard construction, automatic lubrication system for lubricating the ways and all miscellaneous points at every operating cycle are also features of the lathe. Modular type construction provides for maximum flexibility, and the open-bed design gives ample capacity for sluicing chips to the rear of the machine. A convenient loading and unloading device eliminates any lifting of the shell by hand.

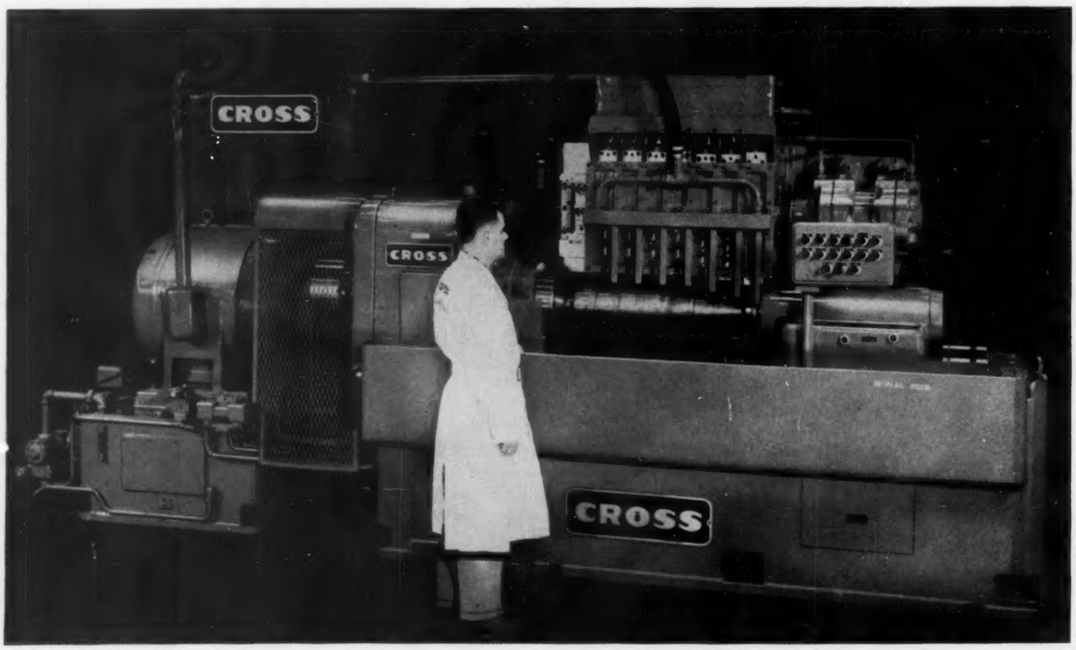
Circle Item 115 on postcard, page 231

Automatic Rotary Wiping Machine

Machine for wiping parts after mask-controlled spraying

The time-consuming method of hand-wiping small parts such as stove, heater, and refrigerator knobs after spray painting or dipping has been made unnecessary by a newly developed automatic rotary wiping machine produced by the Conforming Matrix Corporation, Toledo, Ohio. This machine provides for high-production wiping after mask-controlled spraying which holds the paint to the immediate area.

The variable speed table with twenty-four revolving work-holders permits production rates of from 700 to 3600 wiped pieces per hour. The operator can sit at the machine and feed the parts from the hopper. The parts moving un-



Lathe for machining shells brought out by The Cross Company

der the wiping cloth are revolved until clean, and then removed from the spindle by the unloading device.

The machine requires less than 5 square feet of floor space and is powered by a 1/4-H.P., explosion-proof motor. It is mounted on casters for ready portability.

Circle Item 116 on postcard, page 231

Punched Card Controls Lathe

A Model 14 multiple cycle, single-point production lathe equipped with a punched card control has been brought out by the Sundstrand Machine Tool Co., Rockford, Ill. The control system is simple in preparation, and uses a minimum amount of equipment. Numerical data is taken directly from the engineering detail drawing. Dimensions given on the drawing are punched in standard business machine cards.

These cards are fed into a device that reads them and transmits electrical signals into a machine control unit. In addition to directing machining operations, the cards can be punched to control automatic loading and unloading, gaging, and chip removal. While the system is designed primarily for parallel motions, an insert cam can be applied to obtain a tapered or curved form.

Sundstrand production lathe controlled by a punched card

It is possible to produce an eight-diameter work-piece, with three cuts on each diameter, in one automatic cycle. Spindle motor is 40 H.P. There are four speeds and an infinite feed rate from 7 1/2 to 300 inches per minute.

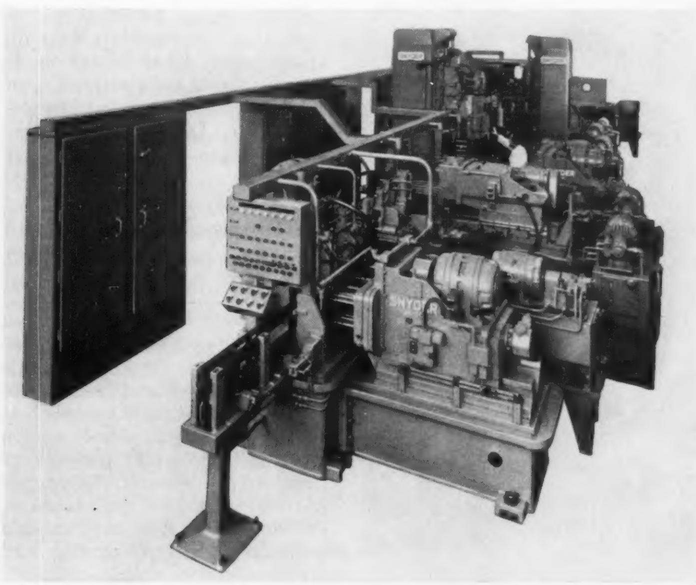
Circle Item 117 on postcard, page 231

Snyder Transfer Machine Processes Automobile Chain Case Covers

An in-line transfer machine for processing cast-iron covers for automobile V-8 engine chain cases has been announced by the Snyder Tool & Engineering Co., Detroit, Mich. Operating at 80 per cent efficiency, the equipment has a production rate of 108 pieces per hour.

This forty-station machine is 65 feet long and consists of eight segments, each having a separate base and control panel. A single transfer bar carries parts from station to station through the machine. A variety of drilling, countersinking, tapping, boring, and milling operations are performed in the first five segments by vertical and horizontal slide units. Hole inspection probes that check drilled hole depths are used in the third and fourth segments. If a hole is not drilled to correct depth, the subsequent segment will not function.

In the sixth segment, the chain case cover is automatically tipped and rotated 90 degrees to locate it correctly for drilling, countersinking, and tapping operations in the seventh segment. After the parts leave the seventh segment, they are moved by the transfer bar through nine stations, where they pass through a wash, rinse, drain, and blow-off unit. Then, the work moves to a fixture in the eighth segment where it is sealed and air-tested for leaks. If a part is found to leak, it is automatically stamped



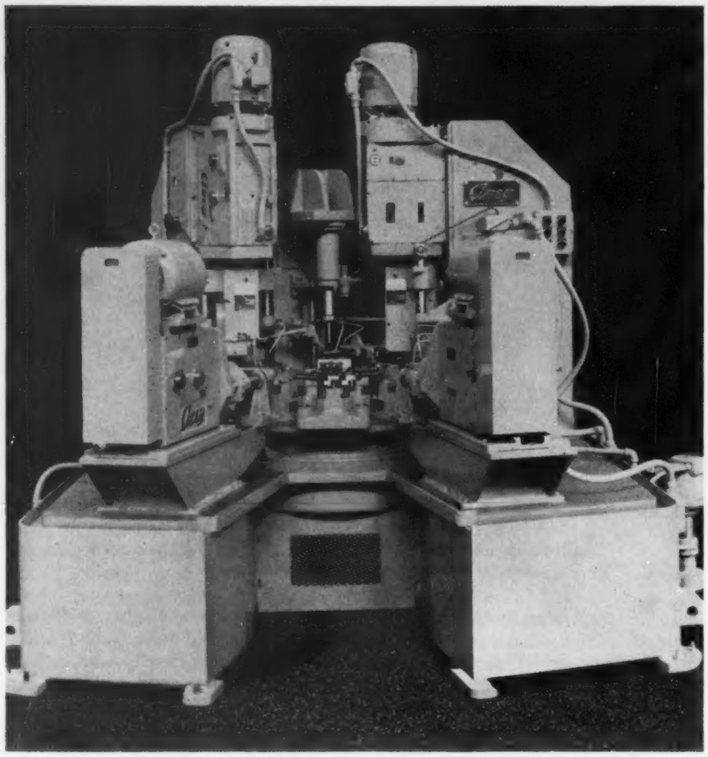
Segmented, in-line transfer machine for processing automobile chain case covers announced by the Snyder Tool & Engineering Co.

and rejected from the transfer line at the next station.

An oil seal is pressed in at the third station in the eighth segment. Oil seals to be pressed into the chain cover cases are stacked in vertical tube hopper feed assemblies mounted on the periphery of an index-table. One of the tubes lines up with a vertical chute at each index position and lets the seals in the tubes feed under a press ram. Micro switches in the vertical chute control the indexing of the table to the next tube position. Controls at the pressing station prevent the unit from functioning unless a seal is ready to be pressed in right side up. Upside-down seals are automatically ejected from the pressing position.

The machine is electrically controlled and hydraulically operated, except for the air testing and stamping equipment.

Circle Item 118 on postcard, page 231



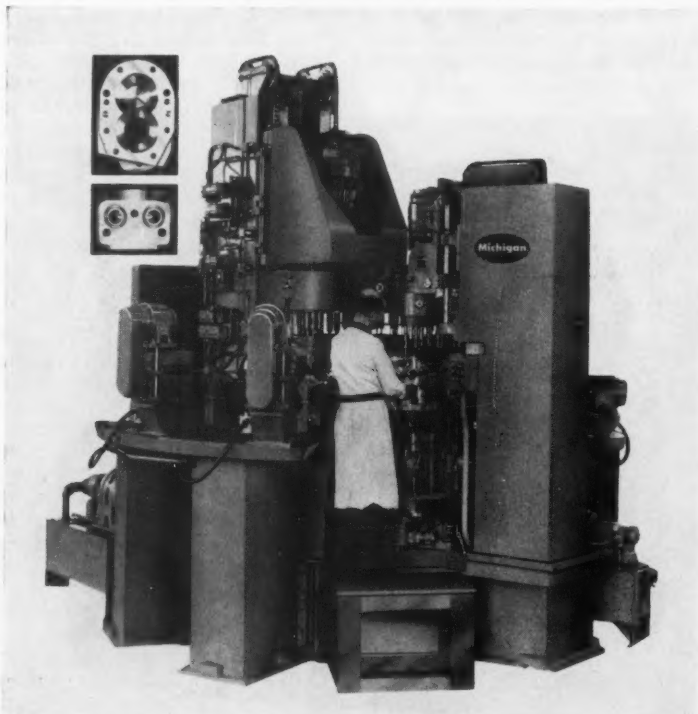
Drilling, tapping, milling, and broaching machine developed by Avey Drilling Machine Co.

Avey Six-Station Machine

A six-station dial type indexing machine drills, taps, mills, and broaches 380 work-pieces per hour. It was built by Avey Drilling Machine Co., Cincinnati, Ohio. Five cam-feed units are positioned at suitable angles around a 36-inch automatic indexing table. The steel base of the machine contains the hydraulic and coolant systems, and has provision for chip disposal.

Quick-acting fixtures are designed to accommodate two different parts. All units and the table are interlocked electrically, and the machine is operated remotely through a J.I.C. control panel.

Circle Item 119 on postcard, page 231



High-production machine built by Michigan Drill Head Co. for processing pump bodies

Michigan Special Machine for Processing Implement Pump Bodies

A six-way, eleven-station machine built by the Michigan Drill Head Co., Detroit, Mich., for the farm equipment and tractor field performs 8520 operations per hour on implement pump bodies. Constructed largely of the company's standard components, the machine has a vertical feed unit, hardened and ground ways, self-contained quill and bar type master lead-screw tapping units, a 60-inch automatic indexing table, and a two-position power-operated fixture.

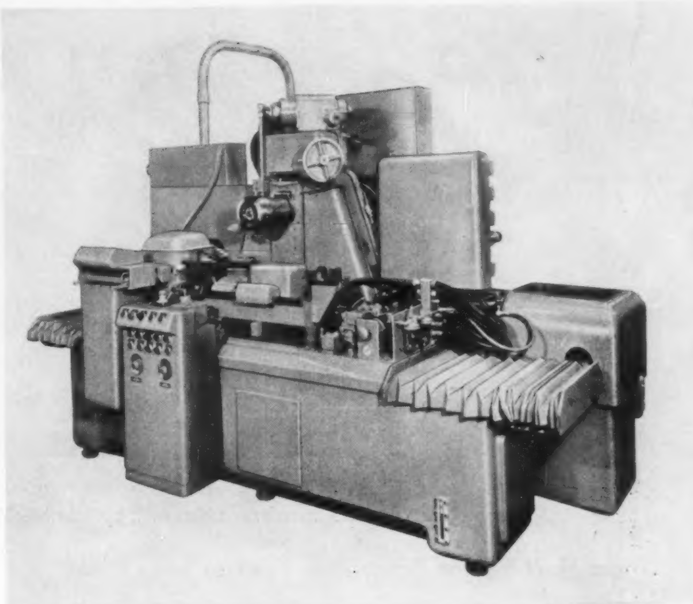
Vertical heads are provided with additional spindles for rapid tool changing, and horizontal units permit angular adjustments. Operations performed on the pump bodies include drilling, chamfering, reaming, end-milling, trepanning, boring, and tapping.

Circle Item 120 on postcard, page 231

Automatic Gear-Grinding Machines

The Gear Grinding Machine Co., Detroit, Mich., has announced the availability of a line of fully automatic machines for grinding gears. Improved features, all automatic, include loading, rejection of faulty parts, stock equalizing, release of work-pieces, down feed, and trimming. Other features offered are controlled flow of coolant through the grinding wheel; single- or double-diamond trimmers for accurately blending of fillets and profiles; multiple-ribbed grinding wheels which engage more teeth simultaneously; multiple, fixed diamond trimmers which cut down dressing time; and a recording attachment which accumulates machine cycle time data for production control.

Circle Item 121 on postcard, page 231



Automatic gear-grinding machine placed on the market by the Gear Grinding Machine Co.

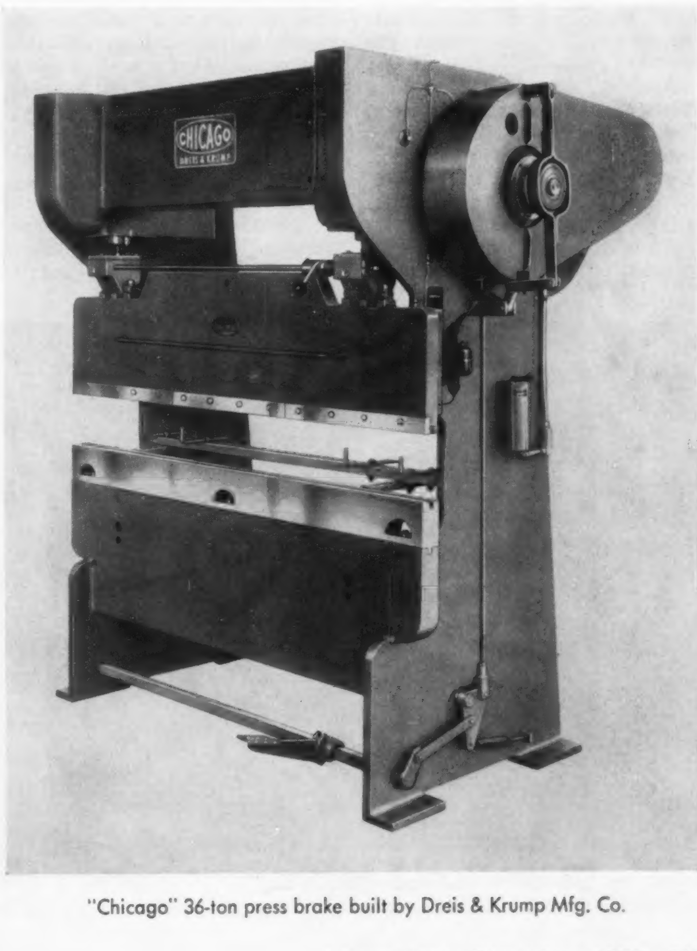
Dreis & Krump Brings Out Four Press Brakes

Dreis & Krump Mfg. Co., Chicago, Ill., announces four new series of "Chicago" press brakes for bending and forming sheet metal and steel plate.

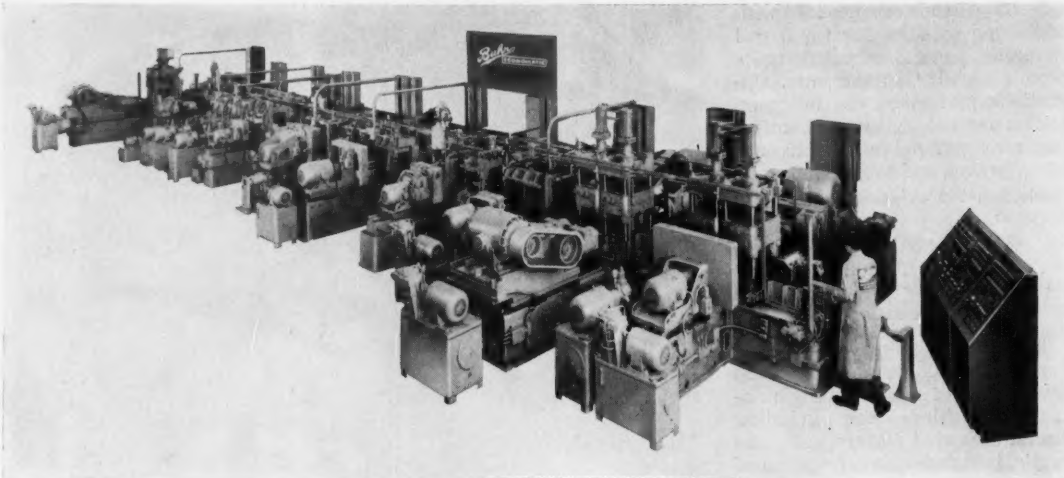
The advanced design of these new press brakes incorporates many features for greater precision and increased production. An all-steel welded frame, and deep-section bed and ram of rolled steel plate assure permanent alignment and minimum deflection under load. A double-end drive from the intermediate shaft eliminates strain, and provides even application over the length of the ram for accurate bending. The one-piece main gear and eccentric at each end rotate on hardened alloy-steel shafts.

The clutch can be jogged or slipped to meet operating conditions. There is a split ram adjustment for tapered work. The press brakes in the series have capacities of 30, 36, 50, and 60 tons.

Circle Item 122 on postcard, page 231



"Chicago" 36-ton press brake built by Dreis & Krump Mfg. Co.



"Economatic" transfer machine built by Buhr Machine Tool Co.

Buhr Machine for Processing Transmission Cases

Automatic transmission cases undergo 249 drilling, boring, reaming, and tapping operations on a forty-five station "Economatic" transfer machine built by the Buhr Machine Tool Co., Ann Arbor, Mich. Fifty-two cases per hour are produced.

Actually, the equipment comprises a battery of three machines. Included are many special, newly developed electronic mechanisms. A typical application is the automatic probing of each hole before it is tapped.

All moving components are lubricated automatically, and ways are constructed of laminated tool steel. Tapping spindles have lead-screws with ground and chrome-plated threads; multiple heads are of ball-bearing construction, with shaved gears and broached and splined drives; and hydraulic and electrical installations are to J.I.C. standards.

Circle Item 123 on postcard, page 231

"Bor-Dril" for Deep Holes

A method of drilling deep holes accurately from the solid, known as "Bor-Dril," is designed to maintain precision limits for straightness, roundness, finish, and diameter. It has been developed by the Ex-Cell-O Corporation, Detroit, Mich. With this method, cored holes in castings can also be completely finish-machined in one operation.

The part to be "Bor-Drilled" is clamped to a simple fixture and held stationary. This facilitates drilling parts of any shape or size. Coolant supplied under high pressure through a gun type drill washes the chips out through the single flute, thus solving one of the problems of deep-hole drilling.

The machine shown in Fig. 1 is equipped to produce a "Bor-

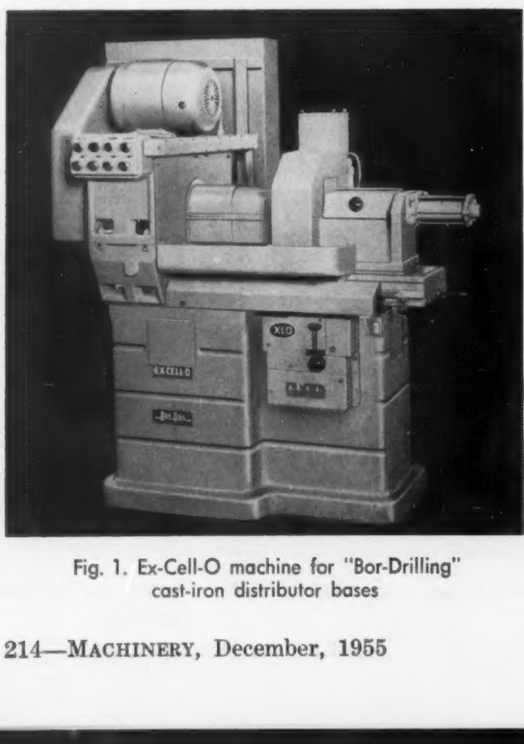


Fig. 1. Ex-Cell-O machine for "Bor-Drilling" cast-iron distributor bases

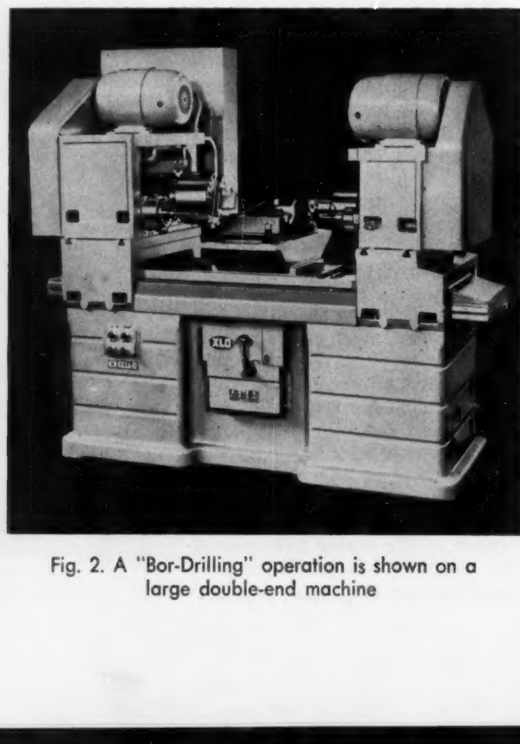
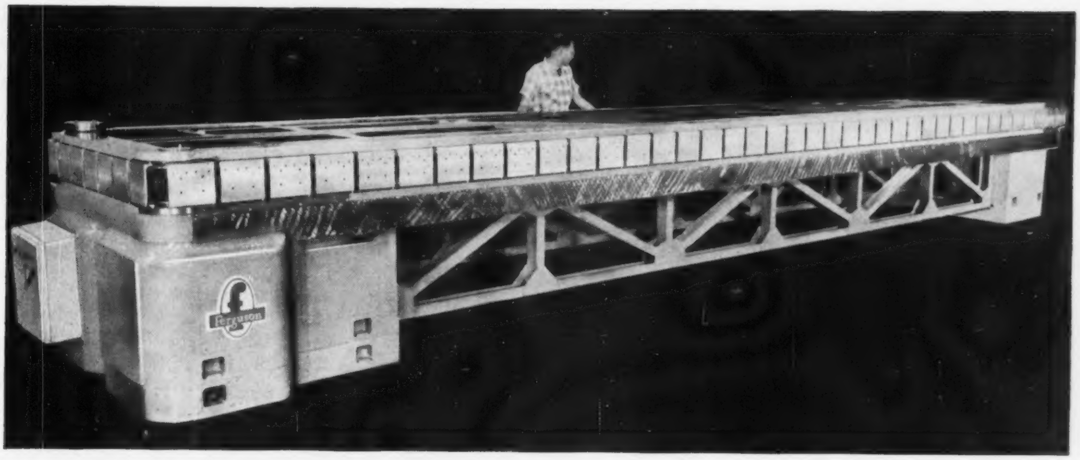


Fig. 2. A "Bor-Drilling" operation is shown on a large double-end machine



"Trans-O-Mator" for assembling automatic steering-gear couplings

Drilled" 5/8-inch hole 6 7/8 inches long in cast-iron distributor bases. The hole is produced straight and round from the solid, and to size within limits of 0.0005 inch. Finish is held within 15 micro-inches r.m.s., and the total machining time per piece is approximately thirty seconds.

In Fig. 2 is shown a large double-end machine equipped for multiple operations on an aluminum casting. Eleven operations are performed in one loading of the work-piece, including line boring, straight boring, facing, and grooving. Feeds and compensating pressures are panel-selected.

Circle Item 124 on postcard, page 231

"Trans-O-Mator" Assembles Steering-Gear Couplings

The Ferguson Machine & Tool Co., Inc., St. Louis, Mo., recently constructed a "Trans-O-Mator" straight-line transfer machine for assembling automatic steering-gear couplings. To meet the requirements of the manufacturer of these automotive components, the frames of two standard "Trans-O-Mator" units were combined. This resulted in the machine illustrated, which is 64 inches wide by 30 feet long, with eighty-eight usable stations. High-speed indexing provides a 9-inch stroke with a transfer time of one and one-third seconds for a load up to 30 pounds per station. Tooling of the machine is arranged for assembling 3600 couplings per hour.

Circle Item 125 on postcard, page 231

Monarch Numerical Sequence Programmer

Automatic electronic sequence programming equipment providing increased versatility of lathe operation has been developed and introduced by the Monarch Machine Tool Co., Sidney, Ohio. Presently arranged to actuate a 10-inch Series EE lathe, the device can also be applied to any lathe in the company's line.

Automatic programmer applied to a Monarch lathe

Key unit in the numerical sequence programming equipment is its electronic control panel. This panel incorporates simple push type selectors which are used to pre-set the various operations desired. Once the proper sequence is programmed with the selectors, a touch of the start button by the operator sets in motion up to five automatic work cycles, using as many as five different speeds and feeds. Any number of identical work-pieces can be turned in succession without further adjustment of the control panel.

Functioning in conjunction with the electronic control panel is an analog-to-digital converter synchronized with the carriage movement of the machine. The converter sends electrical impulses to the control circuits at precise points in the automatic work cy-

cles, thus actuating the various operations called for by the panel selectors.

Changing the programmer for a new sequence of operations is fast and simple, requiring only a resetting of the control panel selectors. They can be changed manually, or a master board can be used which will depress required selectors simultaneously when placed in contact with the control panel; or punched cards computed by a plant methods department can be slipped over the selectors to show through the punched holes the pattern to be set for a given operation.

A special control cabinet is utilized to mount the electronic control panel and related electronic equipment. All electronic components housed in the cabinet are arranged on removable plug-in chassis. These chassis are electrically interlocked, so that the removal of any one chassis from the cabinet will immediately shut off the machine.

The air-gage tracer used with the programmer incorporates a new dual template system. With the dual template, tracer control is provided for both the last roughing and finishing cuts. Shifting from the rough to the finish template is controlled automatically. Positive stops on the cross-slide regulate roughing cut depth during the automatic work cycles prior to actuation of the tracer control.

Automatic Three-Stage Segment Grinder for Color Television Deflecting Yokes

Deflection yokes for the picture tubes of color television receivers made by the Radio Corporation of America are being precision-ground at a high production rate on a special automatic three-stage segment grinder, Fig. 1, built by the DoAll Co., Des Plaines, Ill.

The deflecting yoke is made up of four coils with a core molded in four segments to provide the desired electrical characteristics. These segments, one of which is shown in the grinding position in Fig. 2, are molded from a special ferrite mix and sintered by a process similar to that used for powdered metal parts. The parts are fired at high temperatures and as a result become hard enough to cut glass.

Fig. 1. DoAll special machine designed to grind deflection yokes for picture tubes of color television receivers

To get maximum efficiency from these cores, it is necessary to finish the eight mating surfaces between the four segments (the two ends of each segment) very accurately so that they will form a true cylinder when assembled. Extremely accurate grinding, therefore, is required on both ends of each segment to produce smooth true surfaces at the 90-degree mating ends. This is accomplished by the special machine with paired grinding heads arranged as shown in Fig. 2. These heads are hydraulically actuated to feed the diamond wheels across the end surfaces of each segment.

In operation, the machine automatically loads, aligns, grinds, and discharges the part, grinding both ends of the segment simultaneously. It automatically grinds the segment down to the desired dimension, finish, and flatness in three fast, successive grinds, holding the work to a finish of 16 micro-inches r.m.s. and flatness within twenty-millionths of an inch across the entire surface. Also it maintains the planes of the ground ends at 90 degrees to each other within 50 micro-inches over the 7/8-inch end width, and does this while producing the pieces at a rate of one piece every three seconds.

The segments of molded, powdered ferrite are stacked in a vertical hopper, with their ends facing outward from the machine. A hydraulic loader at the base of the hopper pushes the lowest segment into one of the thirty-six fixtures mounted on the periphery of a large motorized index-wheel 48 inches in diameter. Upon seating the segment, the loader also pushes a lever that causes the fixture to clamp the segment securely in place.

When a part has been loaded, the wheel indexes 10 degrees, moving the loaded fixture toward the first pair of grinding spindles and the next empty fixture up to the loader. The work-pieces are carried through three grinding stations. At each station, the index-wheel stops and is accurately positioned by a hydraulically actuated locking pin. After the index-wheel is securely locked, twin grinding spindles, Fig. 2, moving hydraulically on hand-scraped ways, carry diamond, cup-

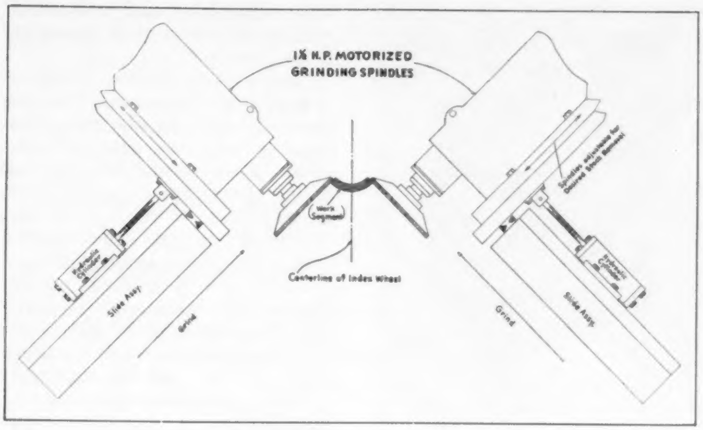


Fig. 2. Diagram illustrating action of hydraulically actuated paired grinding heads of machine shown in Fig. 1

shaped grinding wheels across the segment faces. At the first station, all but 0.035 inch of stock is removed, at the second, 0.025 inch more, and at the third station, the final 0.010 inch of stock to bring the piece to size and to generate the required extremely smooth flat surface that is square within twenty-millionths of an inch.

After completing the pass, the grinding spindles withdraw to the starting position, the index-wheel rotates through an angle of 10 degrees, the loader seats another segment in an empty fixture while the spindles advance again on a grinding pass toward the adjacent fixture. The work-piece is carried past the final position where an automatic ejector drops it to a conveyor which carries it away from the machine.

Gleason Quenching Press Equipped with Automatic Unloader

A completely automatic unloader is now available for the No. 16 quenching press built by the Gleason Works, Rochester, N. Y. The unloader is attached to the left-hand front corner of the press, as shown in the accompanying illustrations, and is controlled by built-in switches and valves. It can be installed on presses in the field or on new machines.

When the press carriage advances to unloading position, the unloader arm rotates into position over the quenched part. The unloader head next moves downward, and adjustable jaws close on the part. Retaining its hold on the work, the head moves upward and rotates through an angle of 180 degrees. The jaws then open, releasing the part.

The quenching press accommodates round, flat, or irregularly shaped parts in sizes up to 15 inches over the largest dimension. Close automatic control at all stages of the cycle is maintained, and parts are held between accurate dies.

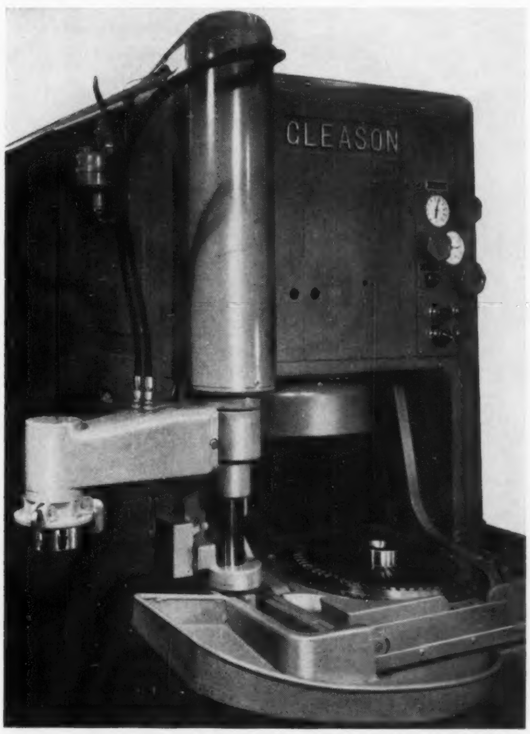


Fig. 1. Gleason quenching press with automatic unloader

Fig. 2. Unloader removing quenched part from press

Hamilton Double-Crank Straight-Side Presses

A new line of double-crank, straight-side presses of welded-steel construction including machines with capacities ranging from 100 to 300 tons has been announced by the Hamilton Press Division, Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. These machines are built to J.I.C. specifications and, in addition, feature gears running in oil, mechanically interlocked pneumatic clutch and brake unit, barrel type motorized slide adjustment, automatic lubrication, pneumatic flywheel brake, die lights, die cushions, pneumatic counterbalances, and an interlocked electrical clutch control mechanism.

Changes in the design specifications of these machines can be made to suit individual requirements and electrical controls are available to meet particular standards. The machine illustrated is a 250-ton, double-crank press with a bed and slide 60 by 36 inches.

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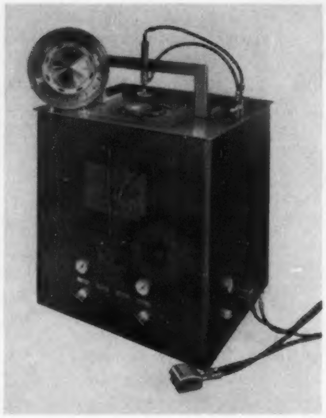


Spray-painting machine built by Conforming Matrix Corporation

Rotary Paint Sprayer

An automatic rotary sprayer facilitates the painting of round and deep-drawn work. Developed by the Conforming Matrix Corporation, Toledo, Ohio, the machine is adaptable to decorating a wide variety of parts such as hub caps, toys, nameplates, and emblems. It will handle areas with diameters up to 15 inches.

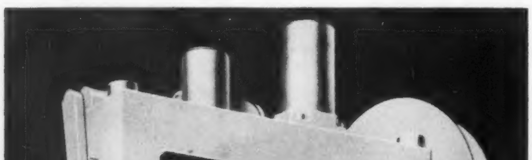
Operation is simple. The part is positioned in a mask, where it is clamped automatically, and a foot pedal or hand valve depressed. The spray guns rotate beneath the mask, operating to a predetermined setting, or they may be used in a fixed position. The completed part is unclamped automatically.

There are four dials on the front of the machine for controlling the atomizing of air to the gun, speed of gun rotation, length of spray time, and the air supply to the machine for automation.

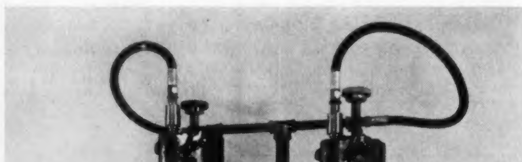
Circle Item 130 on postcard, page 231

Tube-Boring Machine

The Rottler Boring Bar Co., Seattle, Wash., is producing boring equipment for machine shop and manufacturing use in addition to its line of automotive cylinder reboring bars. The machine illustrated is equipped for boring holes 1 3/8 inches in diameter through



Double-crank, straight-side press made by the Hamilton Press Division, Baldwin-Lima-Hamilton Corporation



Machine for precision boring of holes through lengths of steel tubes, made by Rottler Boring Bar Co.

10-inch lengths of steel tubes. Stock to a depth of 0.08 inch is removed in one cut to produce a 40 to 60 micro-inch finish and to maintain a tolerance of 0.0005 inch throughout the length of the bore. Floor to floor time is three minutes per piece.

Circle Item 131 on postcard, page 231

Planet Slot Grinder

Planet Products Corporation, Cincinnati, Ohio, announces a slot grinder. The machine illustrated rough-grinds slots in vane type refrigerator compressor rotors, then finish-grinds them after heat-treating. Material in the rotors is 8655 steel. A surface finish of 5 micro-inches or less is obtained, and total variation in flatness and parallelism of the slot sides is held to less than 0.0003 inch.

Features include: an automatic diameter compensation as wheel is dressed; a two-speed motor—high speed for roughing and low speed for finishing; vertical oscillation of wheel during roughing, to alternately plunge and relieve; an air-oil system to regulate the down feed of the wheel; and pivot-mounting of the wheel-head for simplicity and long life.

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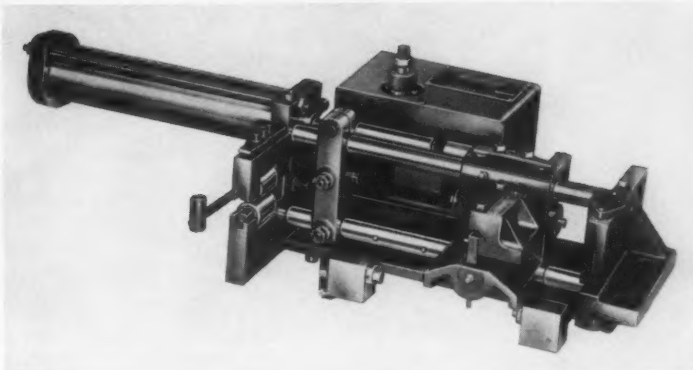


Cooper Weymouth air-operated slide feed for presses

Air-Operated Slide Feeds for Power Presses

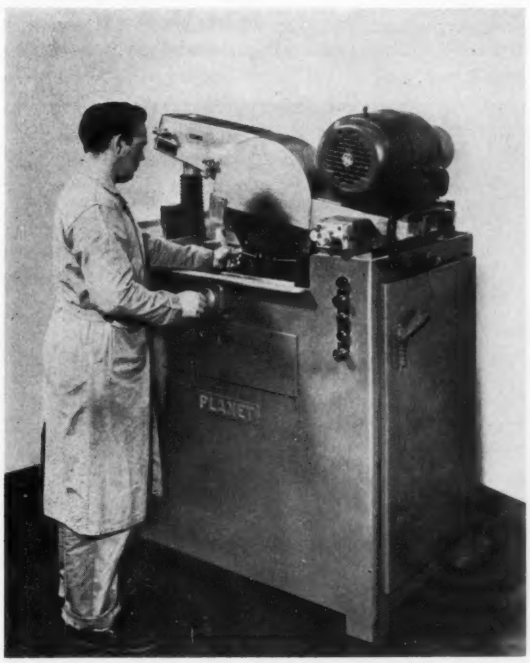
Six- and twelve-inch air-operated open-throat slide feeds for power press operation have been placed on the market by Cooper Weymouth, Inc., Bridgeport, Conn. These feeds can be easily set up and adjusted to maintain a high degree of accuracy.

Five sizes with feed lengths ranging up to 36 inches and widths up to 18 inches are available for use on mechanical and hydraulic presses. They operate from standard shop air lines and can be set to feed from either side or from front-to-back or back-to-front of press.

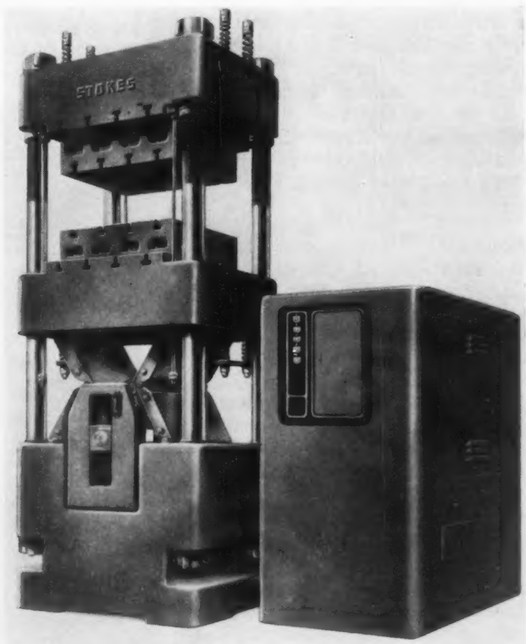
Circle Item 133 on postcard, page 231

Stokes Toggle Type Molding Press

A 50-ton semi-automatic compression and transfer plastics molding press of the toggle type has been introduced by the F. J. Stokes Machine Co., Philadelphia, Pa. This Model 731 press is especially suited for molding shallow parts like resistors, capacitors, and



Planet machine which grinds slots up to 1/4 inch wide and over 1 inch deep



Stokes 50-ton plastics molding press which has regenerative oil circuit

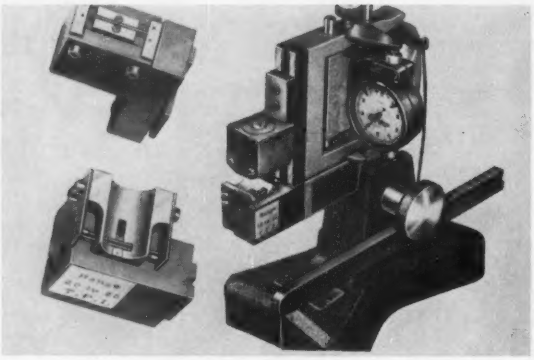


Fig. 1. Pitch-diameter gage employs three-wire method

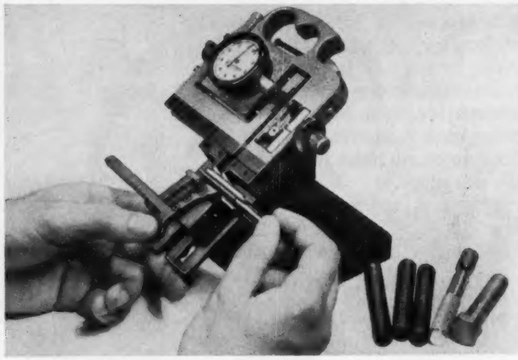


Fig. 2. Lead checker has jaws with adjustable vee edges

similar items requiring delicate insert work.

A patented bar controller gives accurate control over set-up and cycle timing. The controller permits adjustments to be made by means of simple movements of buttons located on graduated bars. When molds are changed the buttons are easily reset; their location can be adjusted even while the press is operating. By recording the settings for a cycle that has been established as satisfactory, it can be readily duplicated later.

Production is speeded up by a three-stage automatically controlled closing action. A regenerative oil circuit gives an exceptionally fast ram approach. At a predetermined point, the approach speed is cut to about 25 per cent, then further reduced to a final closing speed as mold pressure builds up. The mold closes only as fast as the material plasticizes, and molded parts are thus of high density and uniformity.

Circle Item 134 on postcard, page 231

Attachment Combines Facing with Boring

An automatic hydraulic facing unit built by the Belock Instrument Corporation, College Point, N. Y., can be attached to a boring machine to give it added flexibility. This "Hydro-Face" unit includes a hydraulic piston assembly, compound slide with micrometer adjustment, actuating valve, and feed control dial. Precise perpendicularity of face to bore is assured, and machining time is reduced, since both operations are performed simultaneously. The unit has a capacity of facing work 6 inches in diameter.

Circle Item 135 on postcard, page 231

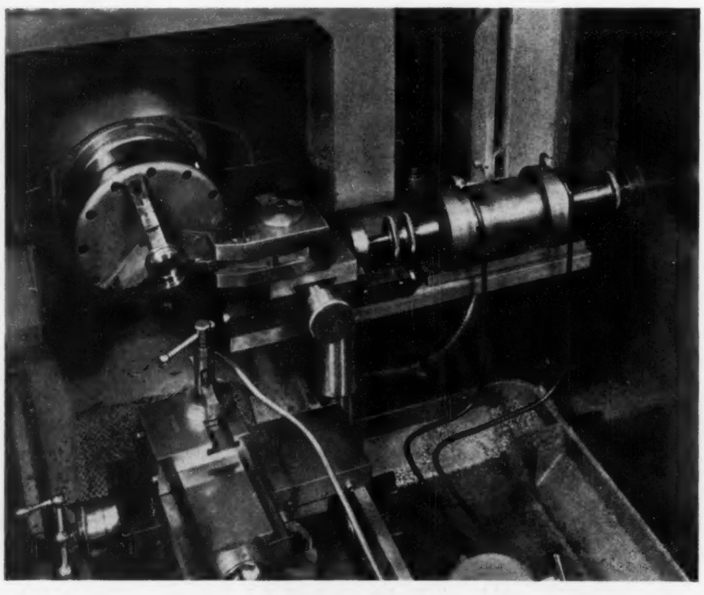
Pitch-Diameter Gage and Lead Checker

An instrument for measuring thread pitch diameter and another for lead checking are announced by Standard Gage Co., Inc., Poughkeepsie, N. Y. Both utilize the company's "Versa-Dial" gage as the fundamental unit.

Measurement of pitch diameter is basically by the three-wire method, but with holder devices of such design that the operator of the gage need not be concerned with the wires themselves. The upper wire is positioned approximately by two plungers which recede automatically under the gaging action. The lower wires are separated slightly by collars, but limited as to maximum spacing. Wires are of tungsten carbide for most pitches. Measuring pressure is adjustable but constant for a particular setting. Therefore, the pressure is the same on the work as on the master, and is independent of judgment, contrasting in this respect with micrometer measurements.

Six sets of interchangeable jaws cover a range of 10 to 56 threads per inch and diameters to 1 inch. Standard equipment includes a dial indicator graduated in 0.0001 inch. The indicator can be faced in the direction desired. A knee-operated mechanism which separates the jaws and frees the operator's hands for positioning the work is also available.

The lead checker has jaws carrying vee edges that can be attached at any desired spacing, setting being facilitated by a fine-adjust-



Belock "Hydro-Face" for boring machines

ment screw. A spring-loaded lever snugs the work-piece against the vees, and lead variation is read directly on an indicator graduated in 0.0001 inch. Jaws regularly stocked suit pitches from 10 to 40 threads per inch and diameters up to 1 inch for American National and Unified Threads.

Circle Item 136 on postcard, page 231

Automatic Testing Machine with Typewriter for Recording Test Results

An automatically controlled physical testing machine with an electric typewriter for printing test results is announced by the Tinius Olsen Testing Machine Co., Willow Grove, Pa. This "Super L" 60,000-pound universal machine has been reduced to push-button operation. It can also be operated manually.

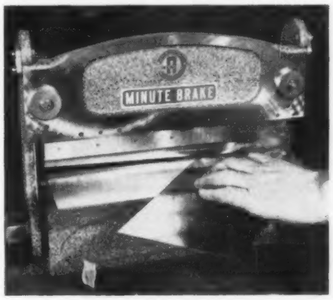
All phases of production tensile tests are controlled by a built-in programmer. This pre-set control insures uniform repeat tests.

The typewriter prints the yield strength for the selected percentage of offset, plus an identifying number for the specimen. Yield strength or other data is determined immediately without time-consuming interpolation of a stress-strain curve. Unskilled personnel can conduct tests quickly and accurately, and results can be compared at a glance.

Circle Item 137 on postcard, page 231

Rotex Press Brake

A low-cost, 12-inch brake has been introduced by the Rotex Punch Co., San Leandro, Calif. This "Minute Brake" is intended for model shops, experimental laboratories, and production departments where space is a factor. Despite its size, the brake can develop 4 1/2 tons pressure in such operations as hemming, internal notching, bending, flattening, corrugating, louvering, and boxing. It shears a 12-inch wide sheet of mild steel up to 14 gage.



Rotex brake which develops 4 1/2 tons pressure

Frame and ram are made of Meehanite, and links are Ductile Iron. A standard handle is interchangeable for either left- or right-hand use, or handles can be provided for both hands.

Circle Item 138 on postcard, page 231

Tinius Olsen push-button controlled testing machine with typewriter that records results of tests

Triangular end-mill and holder made by the Illinois Tool Works

"Tri-Mil" Triangular-Shaped End-Mill

End-mills of radically new design have been developed by the Illinois Tool Works, Chicago, Ill., to perform most of the operations for which two-flute and three-flute end-mills are now used. The manufacturer states that the shape of these new Illinite "Tri-Mil" end-mills has definite performance advantages, in addition to being easy to sharpen and providing an unusually long tool life.

As viewed from the end, the three cutting edges of the Tri-Mil form the points of an equilateral triangle, and the cutting edges run the full length of the tool. Since there is no shank, the new end-mills are held by three-sided collets. This makes it possible to lock the end-mill closer to the work, providing greater rigidity than is possible with a shanked type end-mill. Furthermore, as the end of the mill becomes smaller than the size required, due to resharpening, the worn end can be ground off and new end teeth ground in.

The shape of these Tri-Mils makes them easy to resharpen on a surface grinder, a number of them being sharpened simultaneously. Because the three cutting edges form an equilateral triangle, concentricity of the outside diameter is assured after sharpening.

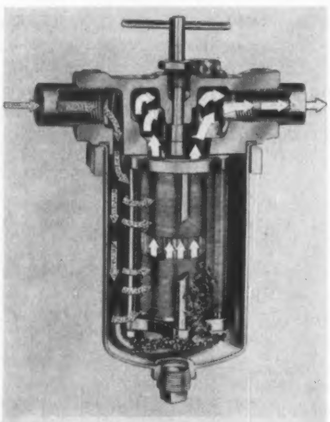
Form milling is possible with these end-mills. Simple surface grinding provides accuracy of form, quickly, because a number of the end-mills can be form-ground in one operation. The end teeth are regularly ground for right-hand cutting.

Circle Item 139 on postcard, page 231

Cuno Cleanable Micronic Filter

A cleanable micronic filter designated the "Super Auto-Klean" has just been announced by the Cuno Engineering Corporation, Meriden, Conn. This filter is similar in some respects to the manufacturer's "Auto-Klean" model, both filters using the principle of metal edge type filtration. Current models of the "Super Auto-Klean" are adaptable to the "Auto-Klean" housings using the same diameter filter element (2 1/4 inches in diameter). Each filter element is composed of a stack of discs and cleaner blades. Visual inspection of cut-away models would not indicate any great difference between the two filters. There is a major and all-important difference, however, in the engineering of the filter area that is not visually apparent.

In the "Super Auto-Klean," the filter element is composed of alternately stacked large- and small-diameter discs of the same thickness. The outside diameter of the smaller (or minor) disc can be precision ground to leave just the right filtration space between its outer ground surface and the inside diameter of the larger (or major) disc. Forty microns (actually 37), 75 microns (0.003 inch), and 0.005 inch are the degrees of filtration thus obtained.



Cuno small, cleanable, micronic filter of high-flow rate

Because of this design, another (or primary) filter is formed in the space (the 0.012 inch thickness of the minor disc) between the outer edges of the major disc. All larger particles are stopped by this primary barrier. This two-stage filter design accounts for the ability of t e "Super Auto-Klean" to handle dirt loads of varying characteristics without undue "loading" of the cartridge.

Circle Item 140 on postcard, page 231

Fig. 1. General Electric instantly reversible type of fractional-horsepower motor

General Electric Fractional-Horsepower Motors

An instantly reversible fractional-horsepower motor, Fig. 1, especially designed for use on door-operating mechanisms, machine tools, cranes, and hoists, has been announced by the General Purpose Component Motor Department of the General Electric Co., Schenectady, N. Y. This motor has a large, built-in, five-stud terminal board with reversing connection diagram on the inside of terminal box cover to facilitate installation. The external switch can be thrown from one polarity to the other as rapidly as is mechanically possible. The motors are available in 1/4-, 1/3-, 1/2- and 3/4-H.P. sizes in 115- or 230-volt, single voltage ratings. All motors operate at 60 cycles, 1725 R.P.M.

A new G.E. totally enclosed, fan-cooled, fractional-horsepower brake motor, Fig. 2, has also been announced. This motor is designed to operate overhead doors, cut-off mechanisms, small elevators, and for other applications where positive stopping or holding of loads in position is desired. The brake

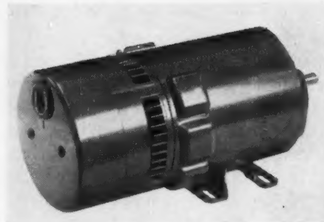


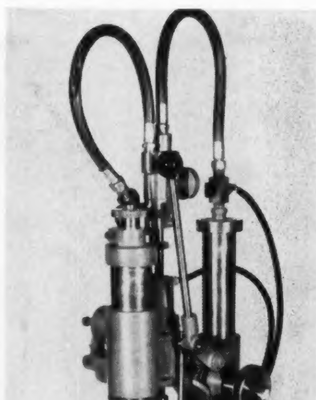
Fig. 2. G.E. fractional-horsepower fan-cooled brake motor

has been redesigned to fit the company's new small-size Form G motor, and together they make a compact, lightweight unit. The combined manual release and wear indicator is recessed in the brake housing for quick, visual inspection. A large finger recess permits manual release even when gloves are worn. These new brake motors are also available in 1/4-, 1/3-, 1/2-, and 3/4-H.P. ratings, at a speed of 1725 R.P.M.

Circle Item 141 on postcard, page 231

Pneumatic Impact Machine

Model 200-VS, a variable-stroke pneumatic impact machine, has been announced by the Heidrich-Nourse Co., Los Angeles, Calif. The machine operates on the principle of a single-shot air hammer, using constant air pressure but with a variable stroke. Traverse



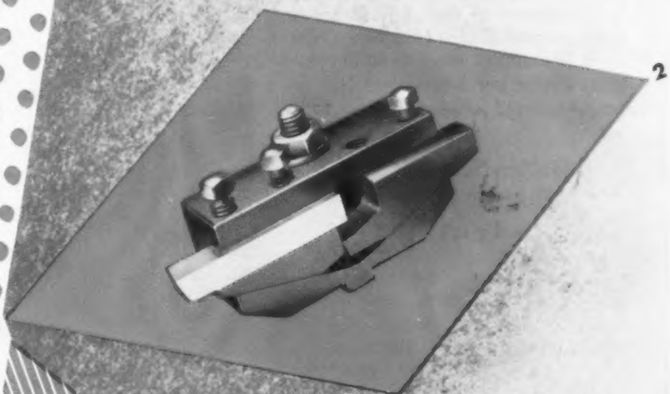
Small impact machine announced by Heidrich-Nourse Co.

1

1. **Releasing Tap Holder, Floating Type,** speeds accurate aligning of tap with work. Holder, with tap, floats on tool body — permits accurate centering before clamping.

2. **New Universal Tool Post for Square Tools** provides unique convenience in adjustment and use. All adjusting and clamp bolts are always on top of tool. Tool can be quickly adapted for right or left-hand turning; on front or back cross slide.

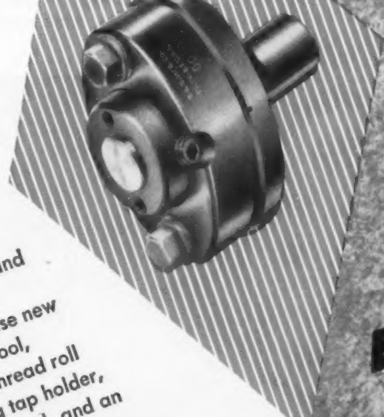
3. **New Floating Reamer Holder** eliminates bell-mouthed and egg-shaped holes. Holder floats freely on anti-friction bearings providing accurate alignment when reamer enters hole.



2

New Production Boosters

...9 new, extra-efficiency screw machine tools



3

Here's real assurance of peak production from your screw machines — with highest sustained accuracy over long periods of operation! These advanced-design 00-size Brown & Sharpe Tools provide increased capacity to ½" ... faster, easier, adjustments ... greater ruggedness. They fully match the high efficiency of Brown & Sharpe "Automatics" and hand screw machines. Besides the 3 tools illustrated, these new tools include: style-4 box tool, boring tool holder, thread roll holder, non-releasing tap holder, balance turning tool, and an adjustable knurl holder. For a complete description of their many advantages, write for illustrated catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I.

Buy Through Your Local Distributor

Brown & Sharpe

BS

of the tool to the work is automatic, controlled by a foot valve. After contact, an over-travel in the mechanism opens the hammer valve. The tool must be in contact before the valve can open.

Features include: uniform impact force regardless of variations in work thickness; independent traverse setting for operator safety; and simplicity of set-up. The impact cylinder assembly can be incorporated in multiple-operation special machines, and mounted at any angle—even upside down. The machine is said to have wide application in such operations as staking, crimping, flanging, riveting, assembling, and impression marking. Impact range is from zero to the equivalent of 8000 pounds static or squeeze pressure. Maximum speed is 6000 complete cycles per hour.

Circle Item 142 on postcard, page 231

Haller Screw-Head Slotting Machine

High-speed production in slotting screw-heads of all types is accomplished with a new machine marketed by Haller, Inc., Plymouth, Mich. This completely automatic machine is equipped with a hopper that feeds screws to a multiple station indexing plate where they are clamped for transfer to a circular cutter. After slotting at the cutter, the screws are automatically ejected and the plate continues indexing for reloading.

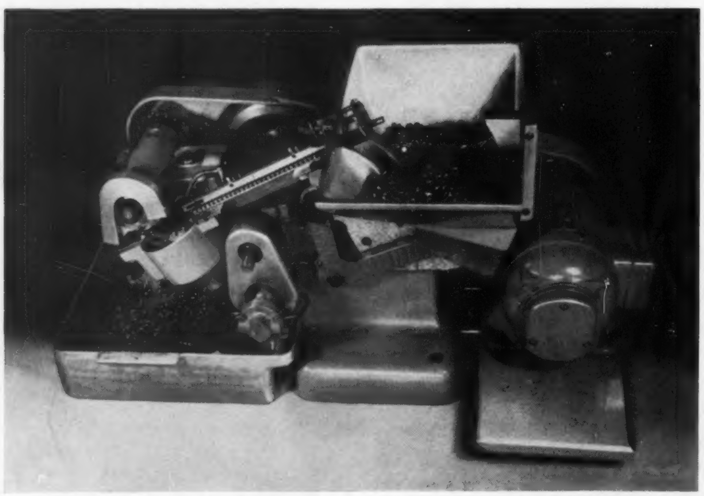
The production capacity of the machine when used without special attachments is up to fifty screws per minute, ranging in size from 0.100 inch in diameter by 1/4 inch long to 1/4 inch in diameter up to 2 3/4 inches long. Screws with heads of any shape can be handled.

Circle Item 143 on postcard, page 231

Fig. 1. Cleveland multiple-spindle drilling and tapping machine

Cleveland Junior Multiple-Spindle Drill-Tapper

The Cleveland Tapping Machine Co., Canton, Ohio, has brought out a multiple-spindle, small-hole



Screw-head slotting machine brought out by Haller, Inc.

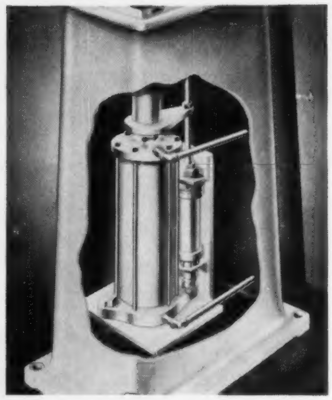


Fig. 2. Air-lift cylinder for fully automatic operation of machine shown in Fig. 1

drilling and tapping machine for use in plants where production does not justify special equipment but where faster precision work is desired. This Cleveland Junior drill-tapper was shown for the first time at the recent Machine Tool Show.

A universal-joint head provides a flexible arrangement of the spindles to suit bolt circle and irregular pattern lay-outs. Up to eight holes can be drilled to No. 25 size or tapped for a 10-30 thread in mild steel. Spindle speed is 2700 R.P.M.

The spindles are adjustable to a minimum spacing of 3/4 inch within an 8-inch bolt circle, and special fixed-center heads or adjustable heads with fewer than eight spindles are available.

In operation, the head remains stationary, the table being raised to feed the tools into the work by downward pressure on the lever seen at the right in Fig. 1. An adjustable spring-counterbalance in the table compensates for variations in the weight of the work and fixtures. The head, likewise, is counterbalanced in the column to facilitate raising and lowering.

For tapping, a switch, operated by an adjustable stop, reverses the motor to back out the tap. A fixed stop again reverses the motor when the top of the stroke is reached. Where fully automatic operation is desired, the machine can be furnished with an air-lift cylinder and "Hydrocheck," Fig. 2, which automatically move the table through any desired stroke up to 4 inches.

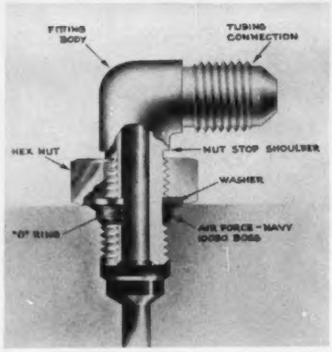
Circle Item 144 on postcard, page 231

(*This section continued on page* 226)

Monarch "Ring Seal" Tube Fittings

The increasing application of hydraulic tubing in machine tools has frequently brought about a perplexing leakage problem due to the poor sealing characteristics of the pipe threads. If a fitting was improperly installed originally, or if it became necessary to temporarily remove a fitting after it had been installed, the resulting deformation of the threads has often resulted in leakage. In addition, proper directionalizing of tube fittings made of very hard materials is usually difficult.

In order to solve the leakage and directionalizing problems encountered with standard type fittings, the Monarch Machine Tool Co., Sidney, Ohio, has developed a new tube fitting design, called the "Ring Seal," which insures perfect sealing even after repeated use. Featuring an "O" ring and boss combination to obtain a leak-proof seal, the new Monarch Ring Seal fittings can be directionalized with ease in any material and require approximately the same installation space as previous designs. No special tools are required to install the new fittings.



"Ring Seal" tube fitting developed by the Monarch Machine Tool Co.

Circle Item 145 on postcard, page 231

Attachments Adapt Boring Machines and Lathes for Grinding Operations

Among the conversion attachments now available from the Standard Electrical Tool Co., Cincinnati, Ohio, is the ram spindle unit for boring mills, shown in Fig. 1. The boring mill illustrated is completely converted into a vertical chucking grinder, the left-hand ram grinding an internal taper at the same time that the right-hand ram is completing an external grinding operation.

The illustration is of a directly coupled, precision motorized unit, with the grinding spindle integral with the ram. A belted motor drive which provides variable grinding spindle speeds is also available. For those who prefer to convert the ram for occasional grinding and metal cutting, a design is available which permits interchanging of cutting tool-holder

Fig. 1. Boring mill adapted to vertical chucking grinder work by attachment made by Standard Electrical Tool Co.

Fig. 2. Grinder attachment for converting vertical turret lathe and boring mills into vertical chucking grinders

Grinding 5-Start Worm with 4" Lead

STANDARD STYLE 36
EX-CELL-O *Precision* **THREAD GRINDER**

In the photograph at the left the operator is grinding a worm shaft for use in a special machine. The part is about 22" long and the worm is 4½" long, 3.430" O.D., has 5 starts, a pitch of .800", a lead of 4" and a tooth depth of .5454". The worm was ground in two operations on a standard Style 36 Thread Grinder. It was rough ground from the solid, hardened, then finish ground.

For complete information and specifications on the Style 36 and other Ex-Cell-O Thread Grinders contact your local representative or write today to Ex-Cell-O.

XLO

EX-CELL-O for PRECISION

A COMPLETE LINE OF PRECISION THREAD GRINDERS

STYLE 36 Precision Thread Grinder—a versatile machine for long external threads, available with internal attachment.

STYLE 50
Precision Thread Grinder—a versatile machine for external work, also available with internal attachment.

STYLE 33
Precision Thread Grinder—a high production machine for external work.

STYLE 39-A
Precision Thread Grinder—a high production machine for internal threads.

STYLE 120
Our largest Thread Grinder. Grinds 10 feet of thread in one setting. Accommodates 12 feet of stock between centers.

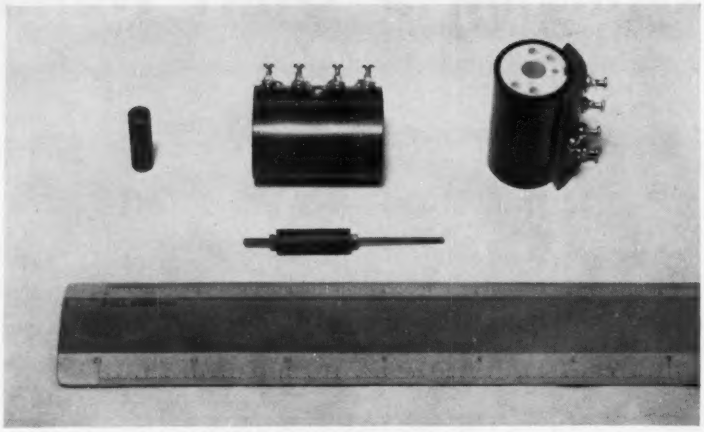
EX-CELL-O CORPORATION • Detroit 32, Michigan

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

with various sizes and lengths of grinding quills.

Grinder attachments of the type shown in Fig. 2 for converting vertical turret and boring mills into vertical chucking grinders are available to suit a range of applications. The package unit shown instantly converts a 36-inch vertical turret lathe into a rotary grinder. This unit has a 3-H.P. totally enclosed, precision motor with variable-ratio belt drive to deliver the correct spindle speed for a wide range of internal and external grinding wheels. The design provides for a minimum of effort in changing the vertical turret lathe from metal cutting to grinding, or vice versa.

Circle Item 146 on postcard, page 231



Baldwin Microformers for measuring small displacements

Position-Sensitive Transducers for Measuring Small Displacements

The Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa., has announced that Baldwin Microformers, which are used to measure small displacements, are now available for general use with optional mounting attachments. These miniature variable transformers, formerly produced only for use on Baldwin recorders and extensometers, have been designed for mounting by means of tapped holes, screw lugs, or flat lugs.

The standard size Microformer has a maximum core travel of 0.12 inch. It is 1 1/2 inches long and 7/8 inch in diameter. A smaller size, 1 inch long and 5/8 inch in diameter, is also available.

Circle Item 147 on postcard, page 231

"Cimplus" Water-Soluble Grinding Compound

A grinding compound has just been announced by the Products Division of the Cincinnati Milling Machine Co., Cincinnati, Ohio. This water-soluble, transparent concentrate is said to give exceptional rust control at dilution ratios of between 1 to 100 and 1 to 200. Although developed primarily as a transparent grinding fluid, it can be used when machining cast iron and also in "Cimcool" mixtures for rust control needed in hard water areas.

Circle Item 148 on postcard, page 231

Lincoln Diesel-Powered Welder

A new Diesel-powered welder for construction, pipe line, and structural welding has been an-

(Continued on page 236)

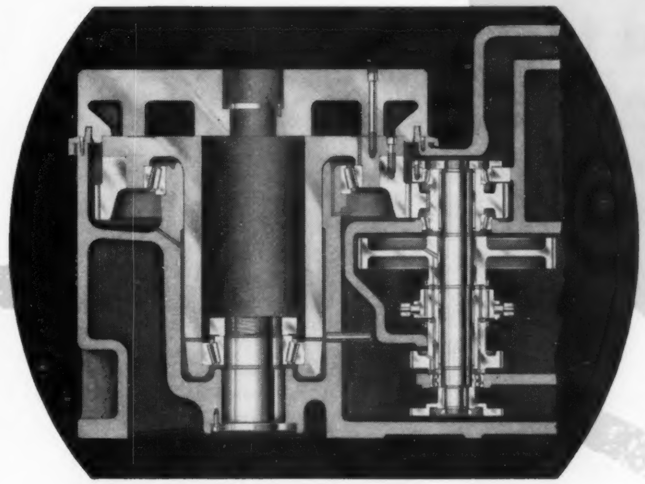
"Cimplus" grinding compound made by Products Division, Cincinnati Milling Machine Co.

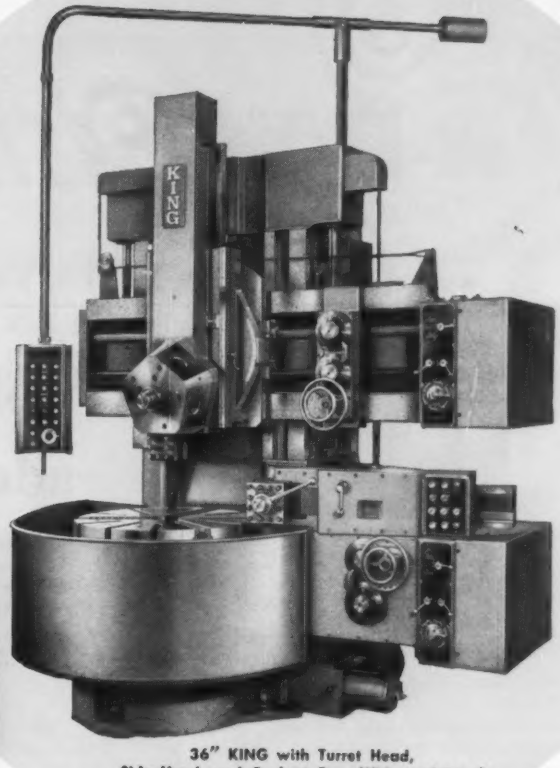
Diesel-powered "Shield-Arc" welder introduced by the Lincoln Electric Co.

New features of the advanced design

KING

assure greatly increased accuracy





36" KING with Turret Head, Side Head, and Coolant Pan. Wide variety of head combinations available.

IMPROVED SPINDLE CONSTRUCTION PROVIDES MAXIMUM TABLE STABILITY

Among the many improvements incorporated in new King® Vertical Boring & Turning Machines is the construction and mounting of the spindle. As shown above, the spindle itself is extra-heavy and rigid. Tapered roller, pre-loaded bearings are placed to provide extreme stability and accuracy of operation. Bearing adjustment as well as spindle assembly removal are quickly accomplished. Helical gear spindle drive completely eliminates any tendency toward spindle deflection. Lubrication is automatic and safety-interlocked.

With many other features—see listing at right—the completely redesigned KING will bring to boring mill users the greatest productive capacity ever achieved for vertical boring and turning work. For full details, send for new Catalog K-5 covering 30", 36" and 46" sizes. (Catalogs on larger sizes will be available later.) Write to us direct or to the King distributor in your area.

MAJOR STANDARD FEATURES OF THE *ALL NEW* KING

INCREASED HORSEPOWER:
40 to 50 H.P. on 30" to 46" sizes.
75 to 100 H.P. on sizes 56" and up.

EXPANDED FEED AND SPEED RANGE:
24 feeds and 24 speeds available.

COMPLETE ELECTRICAL CONTROLS, CONVENIENTLY LOCATED:

Pendant-Located Control of:
- Pre-selective speed selection from direct-reading dial. • Speed change.
- Feed and rapid traverse movements of all heads.
- Power swiveling of rail heads.
- Turret Index. • Table stop.

Fixed Panel Side-Head Mounted Control of:
- Main drive motor. • Rail positioning.
- Thread cutting and taper turning selection for all heads.
- Coolant pump.

DIRECT-READING FEED SELECTION DIAL.

AUTOMATIC LUBRICATION OF ALL MOVING PARTS.

ANTI-BACKLASH NUTS FOR ALL CROSS-FEED MOVEMENTS.

J.I.C. AND NMTBA APPROVED ELECTRICAL CONTROL SYSTEM.

MACHINE ADAPTED FOR SIMPLE OPTIONAL ADDITION OF:
- Automatic positioning of heads.
- Automatic tracing control of heads.
- Automatic cycling. • Power rail clamping.
- Power indexing of turrets.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 Tennessee Ave., Cincinnati 29, Ohio

KING Vertical Boring and Turning Machines

RB&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Selecting the right grade of bolt

With few exceptions, the true function of a bolt is to clamp members together, and not to act as an axle or fulcrum. The residual tension set up in the bolt keeps joints tight.

There's rarely need for costly alloy steel fasteners—not when 3 physical grades of steel can satisfy most "clamping" applications.

SAE grade 1 offers 55,000 psi minimum tensile strength; grade 2, 68,000 psi; and grade 5, approx. 120,000 psi.

The first is used for fasteners which are stress-relief annealed to increase ductility. The next provides low carbon fasteners with a bright finish. The last goes into high-carbon, heat treated black fasteners identifiable by three radial dashes on the head.

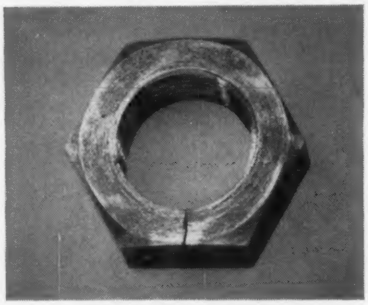
SOME SUGGESTIONS

In terms of holding power, the stronger bolts and cap screws can cost you less than the cheaper bright ones. For example, either a ⅝" with three radial dashes or a ¾" bright cap screw can be used for a safe working load of 20,000 pounds. But being smaller, the high strength one costs less. However, if the same diameter is desirable, then fewer bolt holes need be made and faster assembly achieved when a product is designed to make use of high strength bolts.

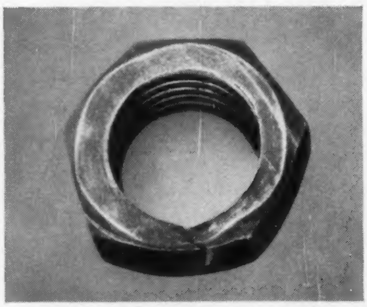
In short, for more pounds of clamping effort per dollar, use high strength fasteners; for more pieces per dollar, use the lesser grades.

Cold Punched Nuts add to safety factor

NUTS dilate when tightened on a bolt. They also adjust plastically to distribute the load over many threads. Since nuts are overdesigned to be stronger than the bolt, these stresses can be disregarded for all practical purposes.



How a defect in hex bar caused split in nut machined from it.



Drift punch had to distort cold punched nut severely, far beyond its yield point before it cracked.

There are times, however, when nuts with optimum assurance against service failure are desired. In such cases, it pays to consider use of RB&W cold punched nuts.

These nuts are punched at right angles to the metal's flow lines . . . same direction as stress encountered in service. No unrelieved stresses are set up. The initial punching automatically reveals any defects. Repunching, an RB&W development, then not only trues up the hole for clean, concentric threads, but also serves as a drift punch test, automatically checking the soundness of these safest of nuts.

For help in applying standard fasteners to assure more assembly strength and less assembly time, feel free to call in an RB&W man. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore, (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

One-piece fastener better than two

One particular oil filter used to be fastened with stud and cap sleeve made by screw machine. This was only until RB&W pointed out that a one-piece fastener could be formed easily on a cold header. The advantages gained are obvious. The single fastener *cost* less, and took *less time* to assemble.

RB&W makes a tremendous variety of strong, uniform standard fasteners to improve assembled metal products. If any of these don't fill a particular need, perhaps an RB&W "special" can be developed that will.

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NEW CATALOGUES

GAP-FRAME DOUBLE-CRANK PRESSES—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 65C, containing 26 pages on the upright Series B and open-back inclinable Series B1 gap-frame double-crank presses. Some of the features are a wide, box type slide fully contained within gibbing, abundance of die area, all-side accessibility of die area, feeding from either side or front to back, integral all-steel frames, precision "V" flat gibbing brought down close to work, over-size air counterbalance, synchronized slide adjusting mechanism, centralized oil lubrication of bearings and gibs, and electro-pneumatic and mechanical sleeve clutches. **1**

INDUSTRIAL ENCLOSED SWITCHES—Micro Switch, Division of Minneapolis-Honeywell Regulator Co., Freeport, Ill. Catalogue 83, containing 28 pages on the company's line of industrial enclosed switches which are designed for use with either alternating- or direct-current industrial applications. Included are general-purpose switches, sealed switches, heavy-duty limit switches, hand-operated switches, and maintained contact switches. The booklet is complete with photographs, dimension drawings, electrical data, and technical information. Ninety different switches are covered. **2**

RAPID BORING MACHINE—R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Bulletin LC-500, containing 12 pages descriptive of the company's rapid boring machine for high production of deep holes. The machine has the following characteristics: high-spindle horsepower, ample rigidity throughout, absence of vibration at all speeds, infinitely variable feeds, infinitely variable spindle speeds, final drive to spindle through belts, and large volume of cutting oil. Specifications and illustrations are included. **3**

HANDLING EQUIPMENT — Cleveland Tramrail Division, Cleveland Crane & Engineering Co., Wickliffe, Ohio. Booklet 2008-L, featuring engineering and application data replete with photographs and drawings showing a variety of installations and equipment details. Thorough analysis of stresses in a number of types of overhead tracks is provided. Track switches, carriers, tractors, cranes, transfer cranes, gantry cranes, automatic handling systems, interlocks, discharge points, electrification, buckets, and grabs are also described and illustrated. **4**

MACHINE TOOLS—Snyder Tool & Engineering Co., Detroit, Mich. 24-page, four-color, illustrated catalogue describing a variety of special machine tools with automation now available from the company. Past, present, and future automation concepts for special machine tools are described from both engineering and application points of view. Twenty automated transfer type, line-index, trunnion type, and rotary-index special machine tools are outlined. **5**

MACHINE TOOL BUILDING—W. F. & John Barnes Co., Rockford, Ill. Brochure describing the company's machine tool building service and explaining how engineering and manufacturing facilities have been expanded and coordinated to offer machine tool users a complete and more efficient service from one source. Special machine tools range from small single-station units to large multiple-station abrasive type machines. **6**

CONTROL RELAY—Clark Controller Co., Cleveland, Ohio. Bulletin PL 7305-PM, completely describing a line of sectional pole, heavy-duty, 10-ampere control relays to occupy minimum panel space. The relays are available in models with from two to twelve poles. Up to eight poles are available when double-decking. The bulletin pictures each of the ten models in the line; gives dimensions, enclosures, features, and data on maintenance and pole conversion from normally open to normally closed. **7**

HACKSAWS AND HOLE SAWS—L. S. Starrett Co., Athol, Mass. Bulletin 1053, containing 60 pages on the company's complete line of hacksaws, hole saws, band saws, and band knives. It includes illustrations, application data, and reference tables covering hand and power hacksaw blades, hacksaw frames, screw-slotting saws, metal-cutting band saws, wood-cutting band saws, meat-cutting band saws, dry-ice-cutting band saws, and band knives for cutting soft or fibrous materials. **8**

FLEXIBLE BALL JOINTS—Barco Mfg. Co., Barrington, Ill. Catalogue 215-B, covering 20 pages on flexible ball, swing, swivel, revolving, and other types of movable joints for use in piping for power, process, heating, chemical, construction, or hydraulic service. Many industrial applications are included. A section is devoted to solving such piping problems as expansion-construction, alignment, and slow rotation. Also noted are maintenance and repair instructions. **9**

HIGH-IMPACT STYRENE—Bakelite Co., a Division of Union Carbide and Carbon Corporation, New York City. Bulletin No. 1, "Bakelite Extruderitems," disseminating in 6 pages information on contour-extrusion and vacuum-forming of Bakelite vinyl, polyethylene, and styrene plastics. This first issue is devoted specifically to high-impact styrene TGD-5001 and its mechanical properties. Extrusion and vacuum-forming technique suggestions are given. **10**

MECHANICAL SEALS FOR PROCESS PUMPS—Garlock Packing Co., Palmyra, N. Y. Bulletin AD-151, containing 12 pages of complete information, including sectional drawings and diagrams, on a

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new series of Unitary mechanical seals designed for use on rotary shafts of boiler feed pumps, chemical pumps, oil-refinery pumps, digestor circulating pumps, and other process pumps. The mechanical seals have the registered trademark "Mechanipak." **11**

METAL-WORKING PRESSES—Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Bulletin 3201, containing 12 pages illustrating and describing the company's line of metal-working presses for extrusion, metal-forming and drawing, forging, bending, flanging, crimping, and straightening. The booklet explains the broad range of applications of these presses and gives typical installation photos and individual tables of specifications. **12**

NUT THREADING—Ex-Cell-O Corporation, Detroit, Mich. Bulletin describing the Scru-Broach machine for production threading of large nuts and other internally threaded operations. The machine in one-, two-, and four-station models is being applied to high-production operations where close tolerance must be held. Illustrations cover representative machines, tools, and parts produced by the Scru-Broach method. . . **13**

VIBRATION MEASUREMENT—General Radio Co., Cambridge, Mass. Booklet consisting of 64 pages covering the meaning of vibration terms, a description of vibration-measuring instruments, procedures, typical examples, and interpretation of results. A short section is devoted to human response to mechanical vibration. Illustrations, specifications, diagrams, and tables are included. . . . **14**

COPPER-BASE ALLOYS—Mueller Brass Co., Port Huron, Mich. 28-page engineering manual containing complete information on copper-base alloys in rod form from the standard free-cutting variety to many special alloys. Some of the characteristics described are machinability, high corrosion resistance, strength and durability, color and finishing surface, and improved forgeability. **15**

ABRASIVE DISCS—Gardner Machine Co., Beloit, Wis. 20-page catalogue listing and describing the company's line of abrasive discs and cylinder wheels. In addition to a chart showing the variable factors influencing the selection of abrasive discs and cylinder wheels, the catalogue gives the types and sizes of abrasives manufactured to meet the various flat surface grinding requirements. **16**

CENTERLESS THREAD-GRINDING MACHINE—Landis Machine Co., Waynesboro, Pa. Bulletin E-97-1, containing detailed information concerning construction, grinding methods, applications, and specifications of the No. 1 centerless thread-grinding machine primarily designed for high-production, precision threading by the through-feed method. The machine may also be utilized in infeed thread grinding. **17**

GEAR-CHECKING MACHINES—National Broach & Machine Co., Detroit, Mich. Bulletin C55-9, containing 16 pages describing the company's Red Ring gear-checking machines and equipment. Capacity tables are included for all models, as well as information dealing with the mathematics of making sine bar settings. Advantages, capacities, and illustrations of models are included. **18**

TAP-HOLDERS AND DRIVERS—Scully-Jones & Co., Chicago, Ill. Bulletin 4-50, containing 8 pages on the company's redesigned line of tap-holders and drivers. Included in the leaflet is specification and application information on heavy-duty tap-holders, close-center tap drivers and chucks, and the new line of "JT" compression and tension tap-holders of the lock-and-eject type. **19**

STAINLESS-STEEL FASTENERS — Star Stainless Screw Co., Paterson, N. J. Catalogue 55A, featuring a complete line of all types of stainless-steel fasteners available from stock, and including diagrams and charts of sizes. A special section is devoted to corrosion resistance tables which serve as a useful guide for the selection of the various types of stainless alloy grades. **20**

ABRASIVE WHEELS—Simonds Abrasive Co., Philadelphia, Pa. Form ESA-244, containing complete descriptive information on the company's extra-strong abrasive wheels for portable grinders. The company's new Simex Red Wheels, which are reinforced for heavy-duty jobs, are described. There is also complete descriptive information listing sizes and specifications available. **21**

ROLLER BEARINGS—Orange Roller Bearing Co., Inc., Orange, N. J. 40-page engineering reference manual giving construction, dimensions, capacities, housing, and tolerance fits on the complete line of company's staggered roller bearings, full type and cage type needle bearings, journal roller bearings, cam followers, cam yoke rollers and thrust roller bearings. **22**

VIBRATION MOUNTINGS—Vibration Mountings, Inc., Elmhurst, N. Y. Catalogue G-55, showing the new spring-flex mountings developed by the company which are suitable for installations from the heaviest impact machinery to delicate instruments which do not create vibration but are affected by it. Illustrations of typical installations are also included. **23**

PRECISION GRINDING MACHINES—Landis Tool Co., Waynesboro, Pa. Catalogue T-55, containing 26 pages on two sizes of the company's centerless grinding machines. Included are fifty-six photographs and sketches, specifications, and descriptions of extra equipment. Illustrations cover a variety of applications and automation ideas for centerless grinding machines. **24**

THROWAWAY INSERT STYLES—Kennametal, Inc., Latrobe, Pa. Form B-300, featuring the company's Kendex tooling with seventeen "throwaway" insert styles. The publication illustrates how Kendex tooling eliminates grinding and describes other advantages. Kendex inserts are made in square and triangular shapes, and provide up to eight cutting edges per insert. **25**

COLLET-HOLDING FIXTURES—Zagar Tool, Inc., Cleveland, Ohio. Manual 15, giving complete information on the company's tools in industry and also on special machinery, including collets, collet fixtures, gearless drill heads, drill jigs, drilling units, drilling machinery, keyway broaches, and broaching machines. Illustrations, specifications, and price list are included. **26**

METAL-CUTTING BAND SAWS—Wells Mfg. Corporation, Three Rivers, Mich. 8-page catalogue giving descriptive data and specifications for company's line of

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metal-cutting band saws ranging in capacity from 3 1/2 by 6 inches up to 12 by 16 inches. Included is a handy blade and speed selection chart for cutting various materials. **27**

BORING BAR—Cyma Corporation, Berkley, Mich. Technical bulletin describing a principle used in boring bar construction. The publication compares deflection of a bar having tungsten-carbide stiffening members with that of a steel bar, and suggests several boring bar designs to overcome industry problems. Sizes of standard bars available, as well as costs, are included. **28**

NOTCHING MACHINES—V & O Press Co., Division of Emhart Mfg. Co., Hudson, N. Y. Catalogue 55, containing 16 pages describing its complete line of notching presses and attachments with detailed press and fixture specificat ons for three notching machine models, two types of segment notchers, and a band punching machine. **29**

GRINDING AND LAPPING MACHINES—Norton Co., Worcester, Mass. Catalogue 1843, containing 32 pages on the company's grinding and lapping machines which include cylindrical grinders; cam, shape, and crankpin grinders; tool and cutter grinders; universal grinders; surface grinders; lapping machines; and special-purpose grinders. **30**

TRACER LATHES—Hydra-Feed Machine Tool Corporation, Ferndale, Mich. Bulletin HDT-55, describing Hydra-Feed copy turning with a tracer lathe design that features top mounting of both the tracer slide and template. Typical jobs performed by these tracer lathes are illustrated and explained briefly. **31**

SURFACE GRINDING MACHINES—Mattison Machine Works, Rockford, Ill. Bulletin 147-2, giving data on the No. 72 and No. 100 high-production, rotary, automatic surface grinding machines. The various models available, some of them with as many as five wheel-heads, are mentioned, and a number of case histories are given. **32**

CAST IRON—International Nickel Co., Inc., New York City. Booklet containing 28 pages with tables, charts, and photographs describing ductile iron, a cast iron that can be bent. An added feature is a convenient listing of typical applications in various industrial fields. . . **33**

DEMOLITION AND DIGGING TOOLS—Ingersoll-Rand Co., New York City. Pamphlet describing paving breaker, demolition, and digging tools for application in any plant handling such hazardous liquids as gasoline, naphtha, benzine, lacquers, or flammable gases or dusts which could be ignited by a spark. . . **34**

PACKING BENCH—Valley Craft Products Inc., Division of O'Neil-Irwin Mfg. Co., Lake City, Minn. Brochure describing the Hydra-Tilt table, a hydraulically controlled packing bench which can be tilted to set boxes weighing up to 10,000 pounds on the floor after they have been packed. **35**

HIGH-FREQUENCY WHEEL-HEAD—Bryant Chucking Grinder Co., Springfield, Vt. 8-page folder describing the company's new Series 800 high-frequency wheel-heads. Complete technical data is given, plus information on alternators and high-frequency motors, specifications, and ordering instructions. **36**

ROTARY SURFACE GRINDING MACHINE—Arter Grinding Machine Co., Worcester, Mass. Leaflet describing the company's Model E hydraulic rotary-surface grinding machine and giving general information on construction, feeds, wheel spindle, chuck, lubrication, electrical equipment, and specifications. . . . **37**

SELF-TAPPING SCREWS—Parker-Kalon Division, General American Transportation Corporation, Clifton, N. J. Catalogue 7-PA, describing different types, uses, and special forms of self-tapping screws made by the company. Six styles are treated and illustrated. **38**

VINYL-CUSHION MACHINE PAD—Air-Loc Division, Clark-Cutler-McDermott Co., Franklin, Mass. Brochure describing Air-Loc, a machinery mount made from Bakelite vinyl, sisal, and cork. Features of Air-Loc are described. Illustrations and advantages are given. **39**

DIE SET DIGEST—Producto Machine Co., Bridgeport, Conn. First issue of a new quarterly publication containing 8 pages entitled "Die Set Digest" which is devoted specifically to information of value to users of die sets and related diemaker's equipment. **40**

SWISS HIGH-PRECISION MACHINE TOOLS—Carl Hirschmann, Inc., Manhasset, N. Y. 8-page brochure which contains information on the new Hauser 3BA jig borer, Tornos Swiss type automatic screw machine, the Schaublin 102-80 lathe cabinet stand, and many others. **41**

ANTI-RUST COATING OIL—Sun Oil Co., Philadelphia, Pa. Technical Bulletin 42, describing an anti-rust coating oil for production of sheet and strip metal and ferrous castings called Sunkote A. The publication tells how to apply this new product. **42**

BORING MILLS—Cincinnati Gilbert Machine Tool Co., Cincinnati, Ohio. Catalogue covering the company's table and floor type horizontal boring mills, rotary tables, and autopositioner, and its 3-, 4-, and 5-foot radial drills. **43**

STAINLESS FASTENERS—Allmetal Screw Products Co., Inc., Garden City, N. Y. 8-page leaflet describing its condensed

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stock list of stainless fasteners, including screws, bolts, nuts, washers, and threaded rods. Specifications are also given. . . **44**

PROCESS AND TRANSFER EQUIPMENT—W. F. & John Barnes Co., Process Equipment Division, Rockford, Ill. 16-page catalogue, containing information on special automatic process equipment and giving illustrations, diagrams, and specifications. **45**

POWER SAW ATTACHMENT—Aladdin Mfg. Co., Kansas City, Mo. Leaflet describing a 3-in-1, compact, portable, power saw attachment that feeds any 1/4-inch electric drill and can turn it into a hacksaw, a jig saw, or a coping saw. **46**

VAPOR SPRAY LUBRICANT—Tower Oil Co., Chicago, Ill. Bulletin L-8, describing the applications of Micro-Moly, a vapor spray lubricant. It is claimed that this pure molybdenum disulfide provides a dry lubricant at all times. **47**

ONE-PIECE MANDREL—Erickson Tool Co., Cleveland, Ohio. 4-page bulletin covering the company's newly acquired line of Westberg Colletmandrels. The booklet gives complete information on specifications and application data. . . **48**

HYDRAULIC TURRET DRIVE—A. W. Cash Co., Decatur, Ill. Bulletin S-740, describing the company's hydraulic turret drive for powering ram type hand turret lathes. The new Cash Standard drive eliminates hand indexing and traversing. **49**

DIAL GAGES—Boice Mfg. Co., Inc., Staatsburg, N. Y. Bulletin 55, on the company's dial gages and Setmasters. It also features ruled sketch sheets making it easy for manufacturers to present their gaging problems to the company. . . . **50**

WAY TYPE HYDRAULIC FEED UNITS—Hartford Special Machinery Co., Hartford, Conn. Leaflet covering data and specifications on the company's new way type hydraulic feed units which feature thrust above the ways near the tool load. **51**

COLD-DRAWN TUBING — Electricweld Tube Division, Jones & Laughlin Steel Corporation, Pittsburgh 30, Pa. Bulletin AD 189, containing 4 pages describing various applications of cold-drawn Electricweld tubing. **52**

COMPARATORS—Pratt & Whitney Co., Inc., West Hartford, Conn. Bulletin 586, 24 pages on Air-O-Limit comparators giving dimensions, and special applications. Diagrams and illustrations are included. **53**

PUNCH PRESSES—Kenco Mfg. Co., Los Angeles, Calif. Folder describing the company's punch-press line ranging from 1 1/2- to 15-ton capacities. Illustrations and details of construction features are given. **54**

LIMIT SWITCHES—General Electric Co., Schenectady, N. Y. Bulletin GEA-6131A, containing 8 pages on lever and rotating cam type limit switches, and giving applications, product features, ratings, dimensions, and prices. **55**

PUNCH-PRESS APPLICATIONS — Diamond Machine Tool Co., Pico, Calif. 20-page catalogue describing the company's punch presses and illustrating case history punch-press applications. Photographs are included. **56**

FILTERS—Cuno Engineering Corporation, Meriden, Conn. Catalogue 058, describing Poro-Klein filters for engineered filtration of high-temperature, highly corrosive, high-viscosity fluids. **57**

DRILLING AND TAPPING UNITS—Kingsbury Machine Tool Corporation, Keene, N. H. 4-page leaflet describing four new drilling and tapping units. Illustrations and specifications are also included. **58**

PRESS BRAKE—O'Neil-Irwin Mfg. Co., Lake City, Minn. Leaflet D-HPPB, containing information on the Di Acro hydra-power press brake with stroke control, and giving specifications, capacities, and illustrations. **59**

OIL-PUMP—Lear-Romec Division, Lear, Inc., Elyria, Ohio. Data Sheet 5-45, describing Model RG-15130 rotary gear, positive displacement hydraulic oil-pump, which has a high volume per weight ratio. **60**

SHARPENING—Aber Engineering Works, Inc., Waterford, Wis. Publication entitled "How to Sharpen Curved Tooth Milling Cutters" containing helpful information for sharpening all types of cutters. . . **61**

HIGH-SPEED STEEL—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Blue data sheet "DBL-2-EZ Free Machining High-Speed Steel" giving information on free-machining high-speed steel of the molybdenum-tungsten type. **62**

TRIPLE-ACTION PRESSES — Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. Bulletin describing triple-action presses featuring an ingenious mechanism that allows a fast advance, slow draw, and fast return. **63**

NUMERICAL CONTROL—Pratt & Whitney Co., Inc., West Hartford, Conn. Pamphlet describing method of translating data, given by numbers in digital form, automatically into machine operations. **64**

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157	158	159	160	161	162	163	164	165	166	167	168	169	170

For more details on products mentioned in December editorial or advertising pages, fill in below:

PAGE . . . . . **PRODUCT** . . . .

PAGE . . . . . **PRODUCT** . . . .

Please print your name and address

NAME . . . .

TITLE . . . .

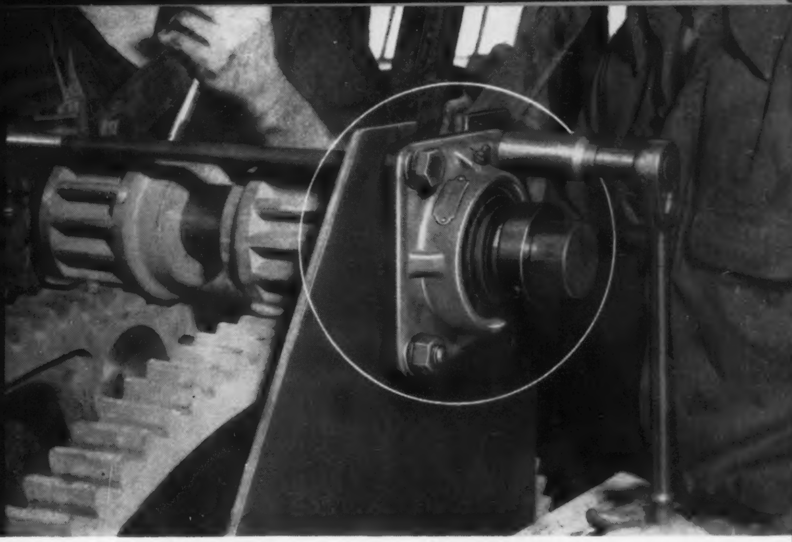
COMPANY . . . .

CO. ADDRESS . . . .

CITY . . . . **ZONE** . . . . **STATE** . . . . . .

This card is void after March 1, 1956 **M-12/55**

If assembly costs are lower



chances are

Fafnir has a bearing on it

Type LCJ Self-Aligning Ball Bearing Flange Cartridge equipped with Wide Inner Ring Mechani-Seal Bearing and Self-Locking Collar. For shaft diam.: $\frac{1}{2}$" to $2\frac{11}{16}$".

The installation of a Fafnir Ball Bearing Flange Cartridge on the pinion shaft illustrated is being made with a socket wrench. No complicated blue prints, no costly machining, no time-consuming fitting and adjusting of bearing. Assembly costs have been cut without cutting corners.

The use of a completely-housed ball bearing unit is only part of this cost-cutting operation. The *Fafnir Unit* offers additional cost savings. Its bearing inner ring is bored for a slip fit. The eccentric cam design of its inner ring and collar makes locking action positive with a twist of the wrist. No lock nuts or adapters are needed. No adjustments of any kind are necessary. The bearing can't be cramped or overloaded when mounting.

If you are looking for a way to cut assembly costs, maybe Fafnir can help you through better, more economical use of bearings. The Fafnir Bearing Company, New Britain, Conn.

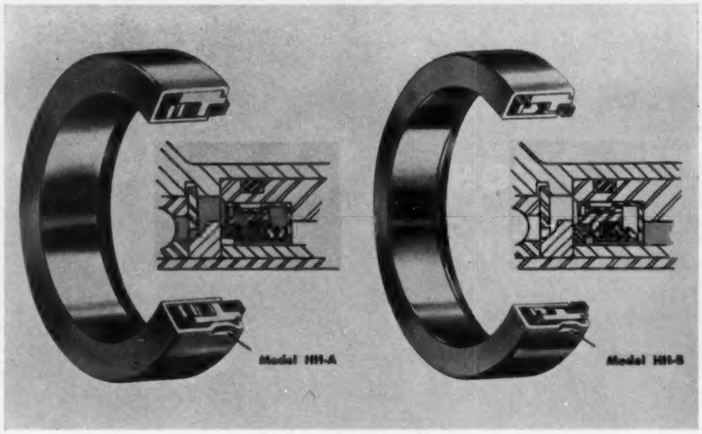
MOST COMPLETE LINE IN AMERICA

FAFNIR BALL BEARINGS

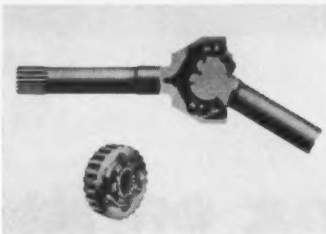
nounced by the Lincoln Electric Co., Cleveland, Ohio. This welder, called the "Shield-Arc SAE-250," has a rating of 250 amperes at 40 volts, 60 per cent continuous-duty cycle, and features a Diesel-powered welding unit.

Regulation of both voltage and amperage is provided for throughout the output range of the welder. The arc can be controlled as to type as well as intensity to permit efficient operation in all positions and under varying conditions.

Circle Item 149 on postcard, page 231



Shaft seals made by Gits Brothers Mfg. Co.: (left) fluid pressure applied externally and (right) fluid pressure applied internally



Rzeppa universal joint available from Gear Grinding Machine Co.

Rzeppa Constant Velocity Universal Joints

A line of Rzeppa constant velocity universal joints of interesting design was announced recently by the Gear Grinding Machine Co., Detroit, Mich. Miniature universal joints included in this line are made in lengths as small as 2 1/8 inches.

Circle Item 150 on postcard, page 231

Gits Shaft Seals

Effective shaft sealing in minimum space (both radial and axial) under extreme operating conditions of temperature, pressure, and seal face surface speed is an important advantage claimed for the "HH Type" shaft seals made by Gits Brothers Mfg. Co., Chicago, Ill. The principal factors contributing to the flexibility and performance of these seals are a variable pressure balance feature and a new, patented method of incorporating synthetic rubber, silicone, Teflon and Kel-F in their construction.

The cut-away view and cross-sectional drawing of the Gits HH-A shaft seal, shown to the left in the illustration, indicate pressure balance when fluid pressure is applied externally. The views of the HH-B seal, shown to the right, illustrate pressure balance when the fluid pressure is applied internally.

Circle Item 151 on postcard, page 231

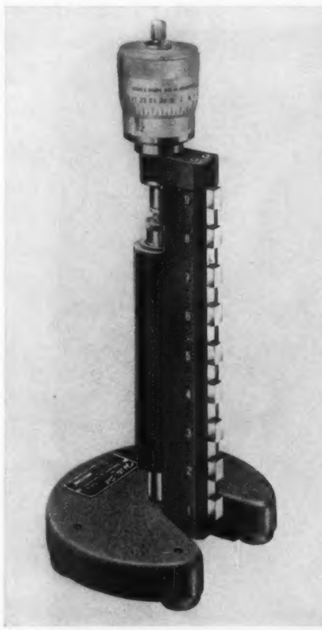


Fig. 1. "Hite-Set" of Brown & Sharpe manufacture

B & S "Hite-Set" and Screw Machine Tools

The "Hite-Set" of the Brown & Sharpe Mfg. Co., Providence, R. I., facilitates height settings and measurements from surface plates and machine tables. This instrument, Fig. 1, consists of a stand having a hardened and lapped base which supports a carrier with permanently mounted precision blocks spaced 1 inch apart. A micrometer head on the top of the stand raises or lowers the blocks, producing settings in 0.0001 inch. The blocks are 0.5 inch thick.

Two "Hite-Set" styles are available: No. 582—a 10-inch size—is designed for in-machine settings as well as surface plate work and has a rectangular base; and No. 583—made in 10-inch and 20-inch sizes—is designed for surface plate work and has a round base.

Nine tools for 00 screw machines are also announced. All have a capacity to 1/2 inch. Entirely new are non-releasing and releasing tap-holders, a thread-roll holder, a boring tool holder with micrometer adjustment, and a floating reamer-holder with anti-friction bearings. Extra ruggedness has been built into the box tool (Fig. 2).

Circle Item 152 on postcard, page 231

(*This section continued on page* 238)

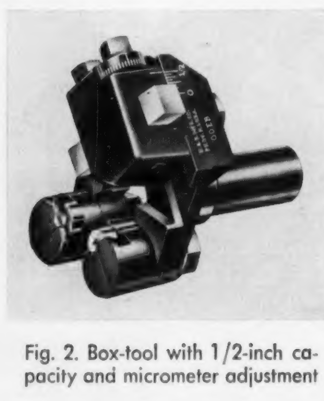


Fig. 2. Box-tool with 1/2-inch capacity and micrometer adjustment

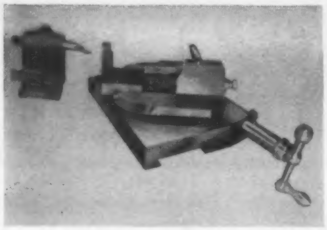


Fig. 1. Wade radius-turning attachment

Radius-Turning Attachment and Tool-Holder

The Wade Tool Co., Waltham, Mass., is producing a newly designed radius-turning attachment with a capacity range of from 0 to 4 inches. This attachment, shown in Fig. 1, allows the radius adjustment to be pre-set to a finished diameter. The attachment is actuated by a worm and worm-gear to give smooth, rigid control when generating spherical surfaces. Although designed primarily for use on Wade lathes, this attachment can be used on other lathes by providing a special adapter plate.

Two tool-holders, as shown, are supplied as standard equipment. The tool-holder mounted on the attachment is used to turn annular grooves or collars. It is shaped to avoid interference with the bar. The other tool-holder is used for turning spherical surfaces on the end of the bar.

The open-side tool-holder, Fig. 2, is another new product of the Wade Tool Co. designed to save the operator's time. This tool-holder provides the flexibility of the standard yoke type tool-holder, but combines with it the rigidity of the conventional open-side type.

One tightening of the wrench serves to lock the tool bit and tool-block securely in place. The tool rocker facilitates adjustments of the 3/8-inch square tool bits.

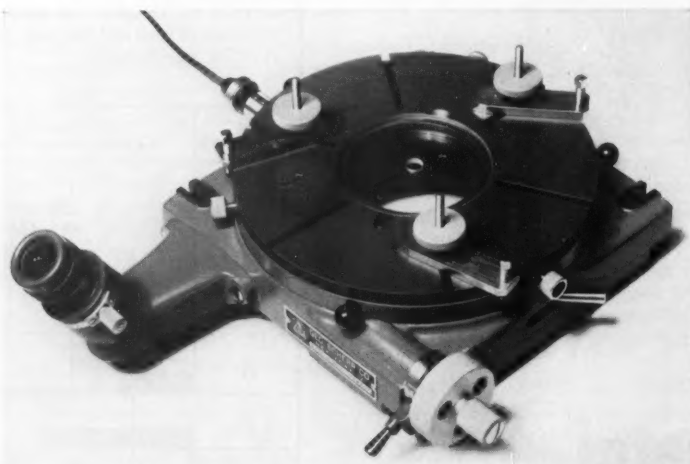
Fig. 2. Open-side tool-holder made by Wade Tool Co.

Circle Item 153 on postcard, page 231

Precision Optical Rotary Table

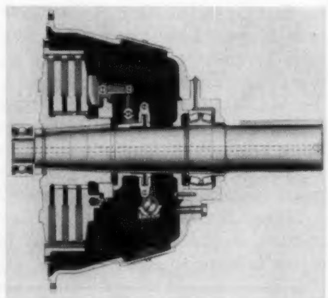
A small precision optical rotary table is being made commercially available as a separate unit by George Scherr Optical Tools, Inc., New York City. This unit is suitable for use in small precision machine tools and coordinate measuring instruments, as well as for difficult inspection set-ups on surface plates, where accurate rotation in a horizontal plane must be combined with other measurements.

The working accuracy of the table is obtained optically, and is therefore maintained indefinitely, as it is not subject to wear. The master is a 360-degree graduated glass circle, which is set to and read through a superimposed optical vernier which is adjustable for zeroing. The vernier scale reads in one minute of arc, with a possibility of estimating 30 seconds of arc, which is the guaranteed accuracy of the table. The inclined eye-piece has individual focussing and is illuminated by a low-voltage lamp against the green field. The 8 1/2-inch table platen can be freely rotated by hand or by a fine-adjustment worm and worm-wheel.



Optical rotary table introduced by George Scherr Optical Tools, Inc.

Circle Item 154 on postcard, page 231



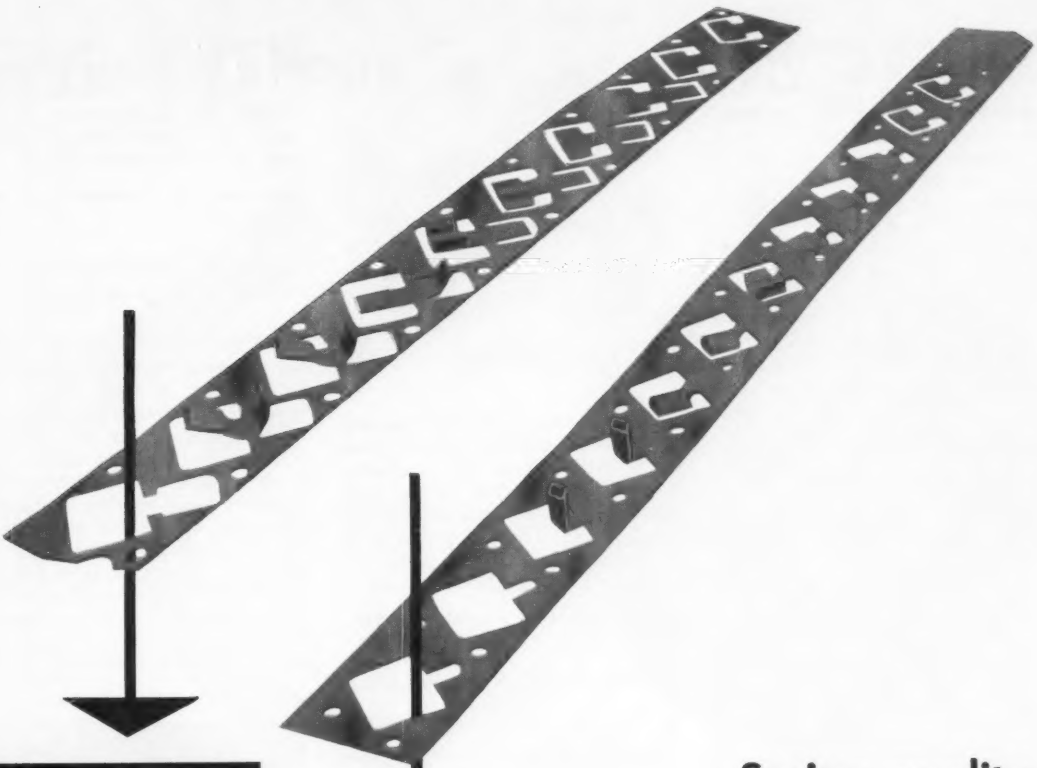
Cut-away view of Twin Disc heavy-duty clutch

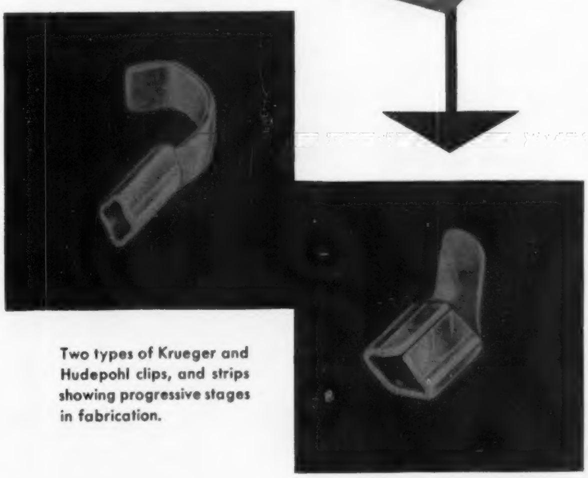
Twin Disc Heavy-Duty Friction Clutch

A heavy-duty friction power take-off clutch designed to meet the requirements of drives from engines in the 350- to 375-H.P. class, operating in the 1800-R.P.M. range has been announced by the Twin Disc Clutch Co., Racine, Wis. This clutch accommodates an SAE No. 0 flywheel and is said to be extremely compact for its capacity rating. With triple drive-plate construction, it assures ample friction surfaces to withstand excessive heat. The solid driving-plate design enables the clutch to effectively handle the stress of high operating speeds.

Circle Item 155 on postcard, page 231

(*This section continued on page* 240)





Two types of Krueger and Hudepohl clips, and strips showing progressive stages in fabrication.

Spring quality of REVERE PHOSPHOR BRONZE makes solderless connections possible

It is not always the case that solder has to be used to make good electrical connections. Often phosphor bronze clips can be used, tightness being achieved through the hard-gripping spring quality of this metal. Take the clips made by Krueger and Hudepohl, Inc., Cincinnati 2, Ohio. This company uses Grade A 5% Revere Phosphor Bronze to make its connections for refrigerators, and for submersible pumps and hydraulic control units. Such services require not only tight permanent connections, but the ability to withstand severe temperature variations, as well as vibration. Revere Phosphor Bronze meets the needs perfectly. In developing this application, the Revere Technical Advisory Service collaborated closely with the customer on the important matter of temper required both for fabrication and end use. Krueger and Hudepohl report no rejects. The metal is supplied in the form of strip, one inch wide, and in very long coils, so that down time for coil set-up on each progressive die machine is minimized. Send for your free copy of "Revere Phosphor Bronze," which provides details about qualities, performance, and applications.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

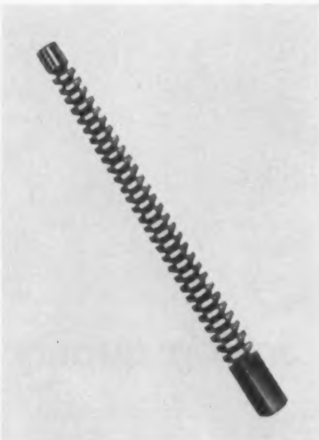
Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

"The Revere Four-Way Service" is a 16mm sound motion picture in color, interesting and informative. If you would like to see it, write nearest Revere Sales Office.

For more information on products advertised, use Inquiry Card, page 231

Push Type Hexagon Broach

High-speed steel, push type, hexagon broach of the "Minute Man" line brought out by the du Mont Corporation, Greenfield, Mass. This hexagon broach is available from stock in eight standard sizes from 3/16 to 3/4 inch. Starting with a round pilot, "Minute Man" hexagon broaches will finish full hexagonal holes in a drilled, reamed, or cast bore in one pass in less than one minute. They can be used in either a hand-operated arbor press or a hydraulic press



and are particularly useful in tool and die work; in sizing work; and in the production of hexagonal couplings.

Circle Item 156 on postcard, page 231

Lovejoy Variable-Speed Pulley for Limited Space Applications

Variable-speed 1/4-H.P. pulley available for limited space applications, brought out by the Lovejoy Flexible Coupling Co., Chicago, Ill. This coupling is so designed that it can be mounted with the belt take-off close to the motor, or reversed so that the belt take-off is in an overhung position away from the motor. The pulley provides for speed ratios up to 2 to 1. An A-section belt is used. The maximum bore diameter is 5/8 inch. Bronze oil-impregnated bearings eliminate need for lubrication for the entire life of the pulley. However, where applications demand lubrication, a pressure grease fitting is provided on the open end of the bore, with grease

channels running to the bearing surfaces. The pulley can be used with the Lovejoy 135 variable-speed base, the 200 tilting base and other sliding-base or shifting mechanisms. The pulley is 3 5/16 inches in length by 3 inches in diameter and weighs 26 ounces.

Circle Item 157 on postcard, page 231

"Kwik-Sand" Abrasive Disc

Newly developed "Kwik-Sand Roto" 5-inch sanding disc accessory brought out by the Creative Products Co., Wilmette, Ill. This sanding disc is useful in the home or farm work-shop as well as in the small service shop or large industrial plant. It is designed to give products or parts of wood, metal, or plastics, a professional finish with safety to the operator and a saving in time. Only seconds are required to change this product from a coarse to a fine grit abrasive disc or vice versa for sanding, or to apply a special abrasive for tool sharpening, or to attach a lamb's wool bonnet for buffing. A safety rim protects the operator's fingers when working close to the edge of the revolving disc. All parts subject to wear and corrosion are adequately treated.

The basic sander comes with a spindle for drill-press operation, but additional interchangeable spindles for use on motors, grinders, or on a speed lathe are available for a slight extra charge.

Circle Item 158 on postcard, page 158

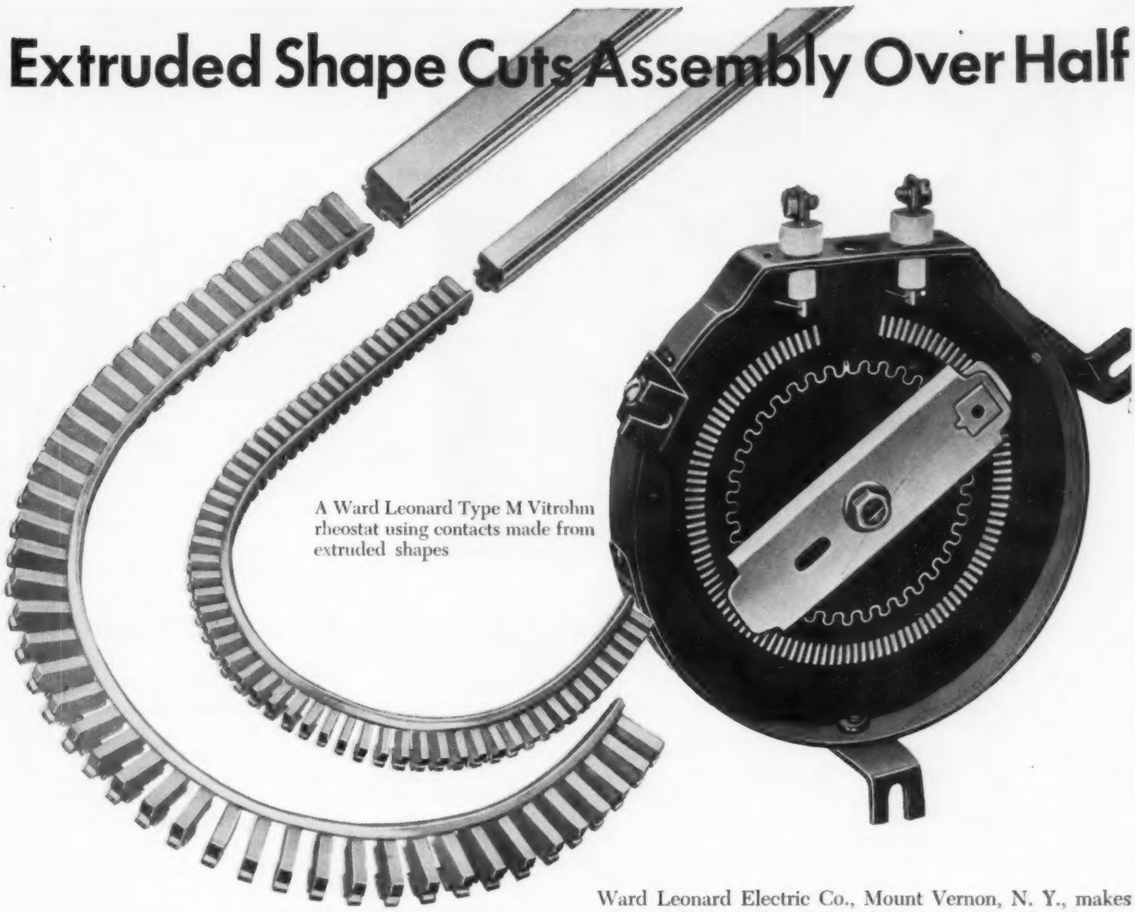
Roller Bearing with Neoprene Housing

Cartridge roller bearing in a flexible neoprene housing, introduced by Rollway Bearing Co., Syracuse, N. Y. Called the Rollway "Flexi-Flange," this new bearing is easily installed and lubricated; it operates almost dust-free; has excellent load-carrying characteristics and allows for slight misalignment of shafts. It is designed primarily for use on farm and industrial materials-handling equipment. The bearing is completely assembled and self-contained, and can be installed with only the aid

of a hand drill and wrench. The hardened bearing race is inserted into the steel stamping providing a clearance of approximately 0.005 inch between the bore of the stamping and the outside diameter of the race. Since both race and stamping are bonded permanently together by neoprene, this clearance allows a misalignment of at least 1 degree between the shaft and the housing. Shaft sizes range from 1/2 to 1 7/16 inches in diameter. The 1/2-inch size supports a radial load of 415 pounds at 100 R.P.M. and the 1 7/16-inch size, 1665 pounds at the same speed.

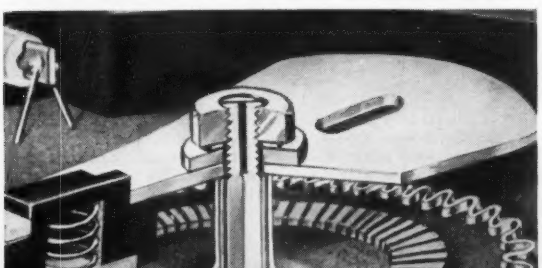
Circle Item 159 on postcard, page 231

Extruded Shape Cuts Assembly Over Half



A Ward Leonard Type M Vitrohm rheostat using contacts made from extruded shapes

Ingenious application eliminates hand assembly, makes absolutely uniform stationary contacts in Ward Leonard power rheostats



CROSS SECTION VIEW of a Ward Leonard Vitrohm Type S rheostat showing how contacts are embedded in a vitreous enamel.

Ward Leonard Electric Co., Mount Vernon, N. Y., makes a line of high quality power rheostats marketed under the trade-name Vitrohm. Anywhere from 41 to 161 individual stationary contacts, or buttons, have to be embedded with their resistance elements in an insulating vitreous enamel—all contacts uniformly set and spaced, for uniform performance. Their patented process originally used buttons blanked out of sheet brass—hand assembled and spaced on a steel wire to hold them while the vitreous enamel was fired.

Ward Leonard refined the process and for four models now starts with the extruded shapes shown above. The stock is accurately slotted for correct spacing, forming a continuous line of buttons connected by a triangular "wire"—which is an integral part of the extruded shape. When sections are curved, the buttons remain uniformly spaced and oriented. After the button assemblies are embedded in the vitreous enamel, the connecting wire is easily milled off. Ward Leonard gets absolute uniformity with less effort and fewer rejects—it gets healthy dollar savings, despite the fact that more than half of the extruded shape is milled out.

Imagination applied to extruded shapes can pay big dividends—lower direct labor costs—fewer machining operations—less scrap—improved product quality. Your Anaconda representative will be glad to work with you. The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5584

ANACONDA®

EXTRUDED SHAPES

Short cuts to a finished product

For more information on products advertised, use Inquiry Card, page 231

Charles J. Stilwell (right), board chairman of the Warner & Swasey Co., presents a fifty-year employe service award scroll to Stephen Lawson at recent Seventy-Fifth Anniversary celebration

Warner & Swasey Co. Celebrates Seventy-Five Years

WHEN 3000 Warner & Swasey employes, together with members of their families, gathered on October 29 at an Open House to celebrate the company's Seventy-Fifth Anniversary, they found many yardsticks by which to measure the progress of this pioneer builder of turret lathes since 1880. Not only had sales risen from $349,000 in the first year to nearly $40,000,000 in the current business year, but the plant facilities and product line gave ample evidence of the growth that had occurred in seventy-five years. From a small machine shop where Worcester R. Warner and Ambrose Swasey produced their original turret lathes, the concern has grown into a manufacturing facility that covers many acres and incorporates several large plant structures.

In the plant demonstration room, visitors witnessed the operation of Warner & Swasey machines seen at the Machine Tool Show. A large circus tent offered ample seating capacity for an entertainment program and the presentation of service awards to employe "old-timers" which included a specially framed scroll for one fifty-year employe and gold watches for nine twenty-five-year men.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (TITLE 39, UNITED STATES CODE, SECTION 233) SHOWING THE OWNERSHIP AND MANAGEMENT

of MACHINERY, published monthly at Bristol, Conn., for October 1, 1955.

1. The names and addresses of the publisher, editors, managing editor, and business managers are: Publisher, The Industrial Press, 93 Worth St., New York 13, N. Y.; Editor, Charles O. Herb; Consulting Editor, Franklin D. Jones; Business Managers, Robert B. Luchars, Edgar A. Becker, and Harold L. Gray. The address of all the foregoing is 93 Worth St., New York 13, N. Y.

2. The owners of 1 per cent or more of the total amount of stock are: The Industrial Press, Robert B. Luchars, Edgar A. Becker, Franklin D. Jones, Walter E. Robinson, Charles O. Herb, Harold L. Gray, Clifford Strock, and Suno E. Larson, all of 93 Worth St., New York, 13, N. Y.; Helena E. Oberg, 65 Eighty-second St., Brooklyn 9, New York; First National Bank of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; Lee W. Noyes, Guardian for Susan Yarnall Urban, Greensboro, Vt.; Lee W. Noyes, Trustee under the Will of Robert L. Urban, Greensboro, Vt.; John T. Urban, 224 Sullivan St., New York 12, N. Y.; and David Ketchum, 13 N. Main St., Cohasset, Mass.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: Charlotte B. Baldwin, 420 Clinton Ave., Brooklyn, N. Y.; Robert B. Luchars and Franklin D. Jones, both of 93 Worth St., New York 13, N. Y.; Ann Pelletier, 140 Cabrini Blvd., New York 33, N. Y.; Elizabeth Y. Urban, 38 Lakeview Road, Asheville, N. C.; Helen L. Ketchum, 231 King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; and Henry V. Oberg, 6825 Almansa St., Coral Gables, Fla.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

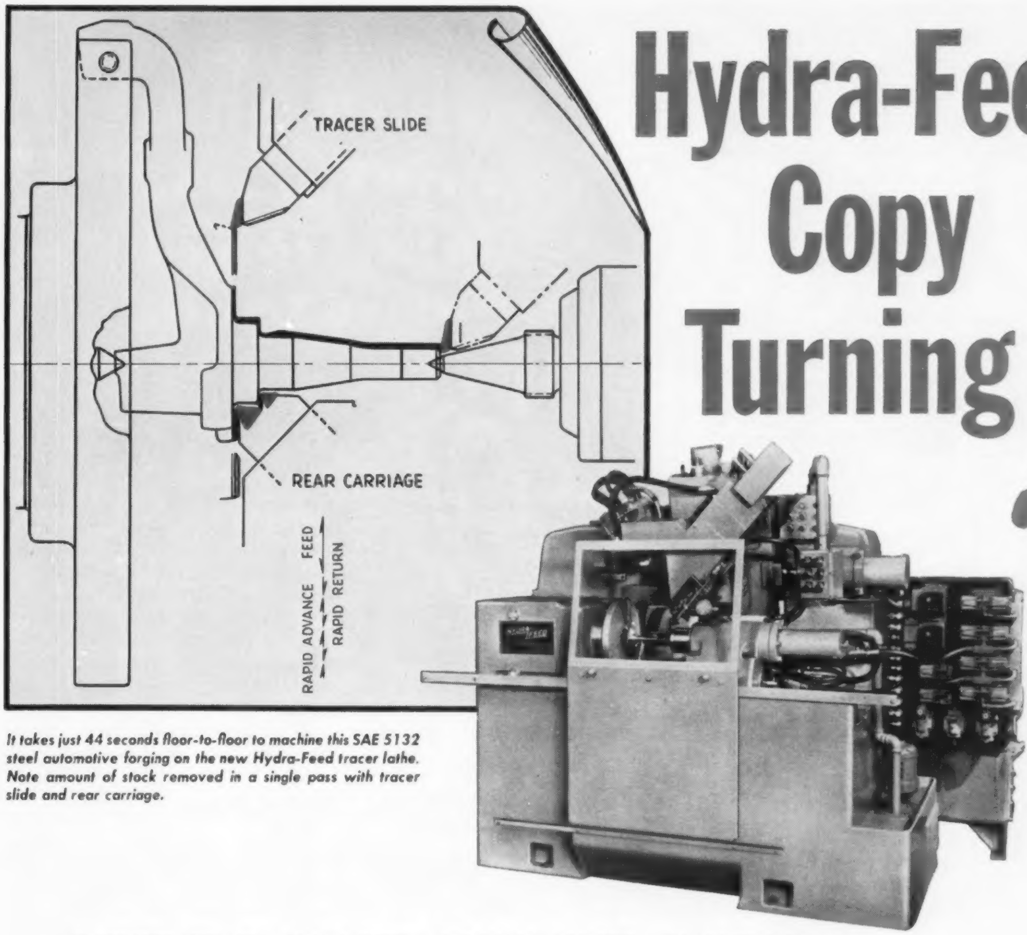
EDGAR A. BECKER, Business Manager

Sworn to and subscribed before me this 15th day of October, 1955. (SEAL).

ALEXANDER LOYKA

Notary Public, State of New York
No. 41-7611350
Qualified in Queens County
Commission Expires March 30, 1956

Hydra-Feed Copy Turning!



It takes just 44 seconds floor-to-floor to machine this SAE 5132 steel automotive forging on the new Hydra-Feed tracer lathe. Note amount of stock removed in a single pass with tracer slide and rear carriage.

HYDRA-FEED TRACER LATHE:

1 . . . gets rid of the chip and dirt problem since tracer slide and template are located on the top carriage, well above the part being turned.

2 . . . gives you unobstructed loading and unloading—no slides or tools at the front of the machine.

3 . . . permits 2 or more operations to be performed in a single pass by using an auxiliary rear carriage for facing, grooving, chamfering, etc. Contour facing and turning are handled with auxiliary tooling, also.

4 . . . with its full width, full depth chip chute allows unobstructed chip flow even when taking the heaviest cuts. Standard automatic chip removal equipment can be added readily since a large opening is provided at rear of the machine.

5 . . . is available with either variable speed or conventional drive to suit your production requirements.

HYDRA-FEED MACHINE TOOL CORPORATION

SOUTH NORWALK, CONNECTICUT AND DETROIT (Ferndale), MICHIGAN

Address all inquiries to:

SALES AND ENGINEERING OFFICE, 730 W. EIGHT MILE ROAD, FERNDALE, MICHIGAN

By E. S. Salichs

The Yule and You

Come Christmas, and we wish all our readers Merriness during the Christmas Season and Happiness in the New Year. Merriness, according to the dictionary, is a rare word. Well, here's to a rare time!

Buttoning Up a Sale

Tom was delivering some sales points on the concrete joists he was hoping a shirt manufacturer would use in the construction of a new plant. Suddenly the executive leaned over, and said "I see you are wearing one of our shirts, but this (prodding Tom's chest) is not one of our buttons." Tom made the sale. He confessed to us, however, he hadn't worn the shirt purposely, and didn't know his wife had replaced the original button.

Picking Up the Glove for a Gear

A reader wrote to the Editor as follows: "If the forman walked up to you with *one* gear which was badly worn or broken, a helical gear, saying 'Make one,' how would you calculate the dimensions required to produce this gear? I have yet to find a man who can give me this kind of information about a helical gear, and I have not been able to find it in any book. Can you help me in this matter?" Whereupon the Editor wrote to Mr. R. J. Kaiser, chief engineer of the Penn Machine Co., who had previously supplied us with data sheets for spur and bevel gears (July, 1950, MACHINERY). He answered with information that will be published as a Data Sheet in our January, 1956, number. The "secret" of calculating replacement helical gears, Mr. Kaiser said, "is in getting the helix angle."

For the Betterment of Beans

Product jamming so far as stringbeans are concerned was a problem to the Food Machinery & Chemical Corporation. But now this beanache is virtually eliminated by using a new fully automatic French style bean slicer, according to the *Industrial Research Newsletter.*

Ironing It Out

A letter from a French engineer published in the August 25th number of *The Iron Age* aroused the concern of our Editor, and rightly so. The comment —under the title "Are We Being Sucked In?"—read in part: "All your friends over here (France, Ed.) are really afraid to see weekly in magazines like *Time* or *Life* and even technical magazines, like MACHINERY, how openly you discuss of your actual process and most up-to-date methods concerning the new nuclear energy." Since nothing along these lines is being published in MACHINERY, the Editor wrote to the engineer asking how he had obtained such an erroneous impression. The Frenchman apologetically replied that upon perusal of his files he found that nuclear energy was not being discussed in our magazine.

Strong Money

A Costa Rican official wrote to the Allegheny Ludlum Steel Corporation that his nation is now using 5- and 10-cent coins made of stainless steel, which, he made the point, "is highly resistant to the wear and tear usually suffered by other metals." We read his letter twice, but he didn't say a thing about money lasting longer.

Never Tightened His English, Though

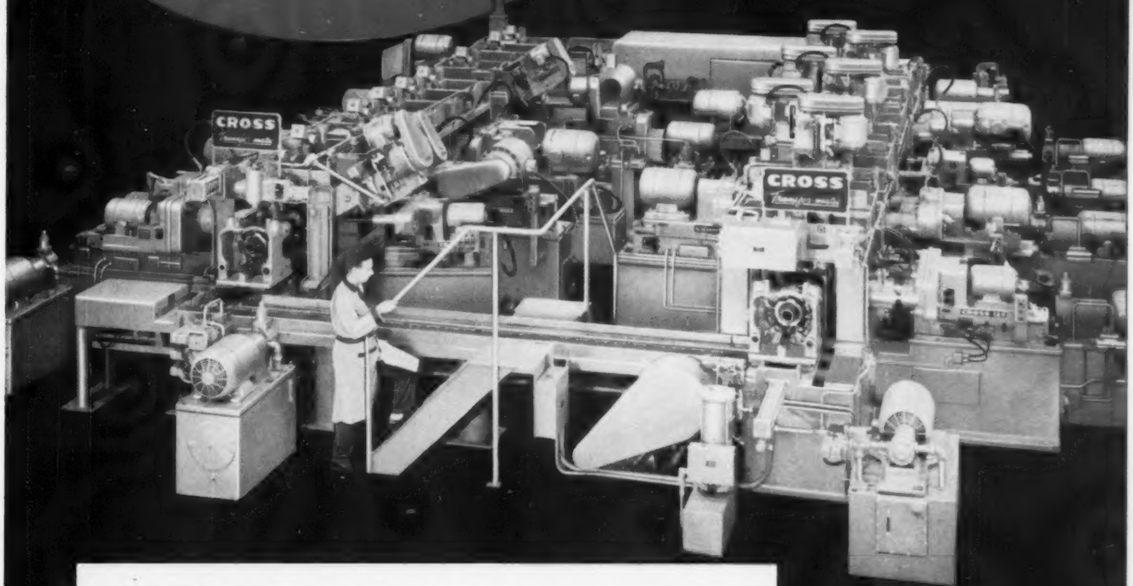
A mechanic recently jolted a purchasing agent with his requisition for a *cresant rinch,* commonly spelled by people who know their Webster, *crescent wrench.*

Beached

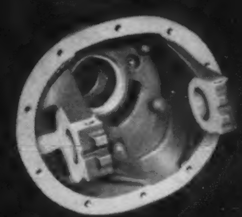
Thumbing through a recent copy of the *National Geographic,* we came across a reference to "bathing machines." Ever alert to new equipment, we paused. Well, they were wheeled bathhouses driven into the water to provide cover for modest bathers, used in England in the days before bathing beauty contests. Horrors, to think there was such a time.

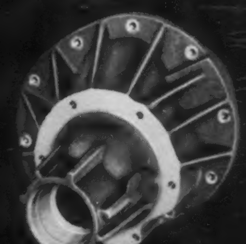
Mills, Drills, Bores, Turns Differential Gear Carriers

Another Transfer-matic by Cross



- ★ Rough and semi-finish bores pinion bores and cross bores; rough and finish faces and turns pilot diameter of torque tube flange; mills faces of cross bore bosses; spotfaces flange mounting holes; drills, chamfers, reams and taps all other holes except flange holes.
- ★ 115 pieces per hour at 100% efficiency.
- ★ 73 operations: 8 milling, 8 boring, 2 crossfacing, 1 turning, 18 drilling, 10 spotfacing, 7 chamfering, 2 reaming, 9 tapping, 8 probing.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ Palletized work holding fixtures with hydraulically operated torque wrenches for clamping and unclamping parts.
- ★ Washing and drying unit for cleaning fixtures between last cutting station and loading station.
- ★ Other features: Construction to J.I.C. standards; hardened and ground ways; hydraulic feed and rapid traverse; automatic lubrication system.





Established 1898

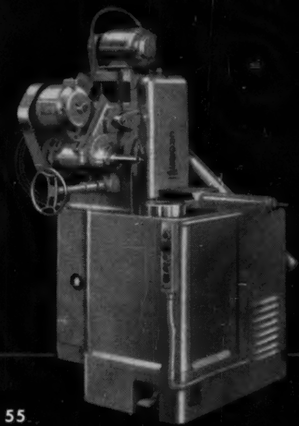
THE **CROSS** CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

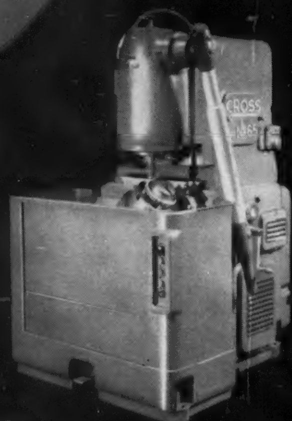
for rounding • chamfering • pointing • burring

Greater Flexibility with Cross Gear Machines



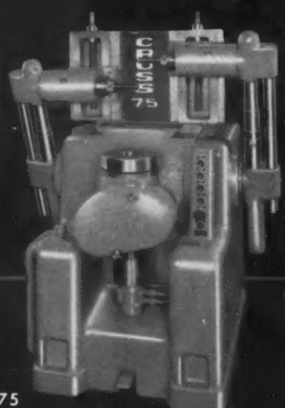
NO. 55

For rounding, pointing, chamfering or burring external and internal—
spur gears • helical gears
clutches • splines
Typical production—rounding or pointing 8 pitch 30 tooth gears—55 net hourly.



NO. 65

For pointing or chamfering external and internal—
clutches • spur gears
bevel gears • splines
Typical production—pointing 10 pitch 30 tooth gears—100 net hourly.



NO. 75

For burring or chamfering both ends at the same time—
helical gears • spiral bevel pinions
hypoid pinions
Typical production—chamfering 8 pitch 40 tooth gears—200 net hourly.

- ★ Flexibility for handling a wide variety of gears.
- ★ Rugged, heavy duty construction for continuous high production or job shop operation.
- ★ Short setup time (as little as 15 minutes) for changing from one gear to another.
- ★ Simple, inexpensive tooling.
- ★ Push button controlled automatic cycle.
- ★ Hydraulic power work clamping.

For mass production or short run jobbing operations, there is a Cross Gear Machine to suit your requirements.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 231

News OF THE INDUSTRY

California and Louisiana

RODNEY METALS, INC., New Bedford, Mass., has opened a new office and warehouse at 4312 Pacific Way, Los Angeles, Calif., under the personal supervision of WILLIAM BROWN. The new company is known as RODNEY METALS OF CALIFORNIA, INC., and specializes in precision-rolled, thin metal strip.

HAROLD HOLSTEN has been named field engineer in the Abrasives Division of Elgin National Watch Co., Elgin, Ill. He will have his headquarters in Monrovia, Calif., and will cover territories of California, Washington, Oregon, and Arizona.

ARTHUR J. ALLCOCK, JR. has been made chief staff engineer of Sterling Electric Motors, Inc., Los Angeles, Calif.

W. M. CHAMPION has been appointed district manager of the Shreveport, La. sales office of the Air Reduction Sales Co., New York City. He replaces John Lund.

Illinois, Missouri, and Indiana

ILLINOIS TOOL WORKS, Chicago, Ill., announces construction of an addition to the plant of the Shakeproof Division, Elgin, Ill. ANDREW L. PONTIUS has been made general manager of that division in charge of all phases of operations. SILAS S. CATHCART has been made general manager of Shakeproof's Special Products Division in Des Plaines, Ill.

GILBERT R. STOCUM has been made sales engineer for the Cleveland Vibrator Co., Cleveland, Ohio. He will be a representative for the company in the state of Ohio and will have his headquarters at 7333 North Ridge Ave., Chicago, Ill.

ROBERT A. HUMMERT has been named Chicago district sales manager for De Walt, Inc., Lancaster, Pa., manufacturer of woodworking equipment. His territory consists of several counties in Illinois. He will make his headquarters in Downers Grove, Ill.

JACK WHITESIDE has been promoted to vice-president of American Gage & Machine Co., Chicago, Ill. He was formerly general manager of the Simpson Electric Division of the parent company.

GREER HYDRAULICS, INC., Jamaica, N. Y., announces the appointment of HYDRO-AIR, INC., St. Louis, Mo., as distributor for Missouri, Nebraska, Kansas, western Iowa and southern Illinois. Hydro-Air, Inc. has headquarters at 1315 South Vandeventer Ave., St. Louis 10, Mo. WALTER MOEHLENPAH heads the distributing organization.

(Left) Andrew L. Pontius, general manager, Shakeproof Division, Illinois Tool Works; and (right) Silas S. Cathcart, general manager, Shakeproof Special Products Division

ARTHUR G. BIGNALL has been elected president of Lasalco, Inc., St. Louis, Mo., replacing HERMAN STRUCKHOFF, who has resigned in order to establish his own metal-finishing supply company on the West Coast.

CLYDE W. SMITH has been appointed district representative by the Columbia Tool Steel Co., Chicago Heights, Ill., for the Indiana territory. He will make his headquarters at 4402 Carrollton Ave., Indianapolis, Ind.

Michigan and Wisconsin

MICHIGAN TOOL CO., Detroit, Mich., announces the following appointments: J. J. PLUMB has been made purchasing agent and DUNCAN E. VERTREES, JR., has been promoted to service manager for the Machine and Tool Division, Detroit, Mich. MILTON C. TON has been made purchasing agent of the Cone-Drive Division, Traverse City, Mich.

E. J. WELLER, manager of tool sales, Carboloy Department of General Electric Co., Detroit, Mich., has been made manager of a newly established carbide products design engineering section. He began his career with the company as an apprentice machinist in 1937 and became a diemaker shortly thereafter.

BUNTING BRASS & BRONZE CO., Toledo, Ohio, announces the purchase of the Detroit Sintered Metals Corporation, Detroit, Mich., which becomes a wholly owned subsidiary, but will continue under its present management to manufacture sintered metal parts and bearings as in the past.

FIRTH-LOACH METALS, INC., McKeesport, Pa., has opened a sales office and warehouse at 18320 W. McNichols Road, Detroit, Mich. WILLIAM H. FRITZ, JR., has been appointed district manager and WILLIAM D. HUSTON has been made sales engineer.

JOSEPH H. COHEN, project engineer of The Cross Company, Detroit, Mich., has been named winner of two national awards for his design of a hydraulic power unit used on automation machines.

D. T. MEISEL has been made advertising manager of Whitman & Barnes, Inc., Plymouth, Mich.

GEUDER, PAESCHKE & FREY CO., Milwaukee, Wis., announces the following appointments: HAROLD E. WHITELEY has been named manufacturing manager; NEIL E. GEISLER has been promoted to chief production engineer; LESTER C. MCKAY has been made master mechanic; BONNER HOFFMANN has become manufacturing controller; N. MARTIN STEFFENS has been promoted to director of materials; and ELLIOT H. THOMAS has been placed in charge of the Lebanon, Ind., plant.

REGINALD WHITSON has been appointed West Coast regional manager for the Warner Electric Brake & Clutch Co., Beloit, Wis. He will make his headquarters at 116 S. Euclid Ave., Pasadena, Calif. Mr. Whitson succeeds VERN D. ENWALD, who will become midwestern regional manager. WESLEY E. TIMMCKE has been made southern regional manager. He will be located at 1335 La Vista Road, N. E., Atlanta, Ga.

SIMPLEX MACHINE TOOL CORPORATION, Milwaukee, Wis., announces the election of the following officers: LAMBERT G. NEFF, SR., has been made chairman of the board; LAWRENCE J. RADERMACHER, president; and VERNON A. FORSBERG, secretary and treasurer.

GEORGE E. SHOUP has been elected executive vice-president of the Dumore Co., Racine, Wis.

New England

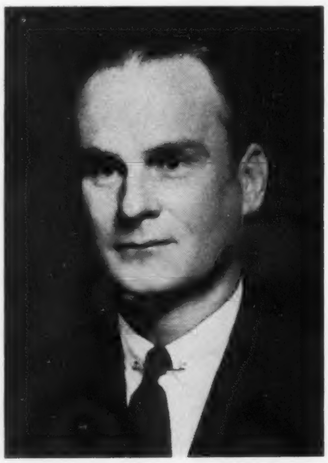
VAN NORMAN CO., Springfield, Mass., announces the appointments of ABBOTT F. STEVENS as advertising manager for both the Automotive and Machine Tool Divisions of the company and of JOHN E. MOTT as general service manager for both divisions.

John E. Mott, general service manager, Van Norman Co.

NORTON CO., Worcester, Mass., announces the following changes: ROBERT H. JOHNSON, formerly abrasives engineer in eastern Iowa, has been transferred to the territory consisting of Florida and the southern portions of Georgia and Alabama. RAYMOND B. GOODALE, formerly engineer in Chicago, has been appointed abrasives engineer for eastern Iowa. HOWARD P. CHACE has retired as chief sales engineer of the Grinding Machine Division, having joined the company in 1911. He was the first time study man of the company. For many years he has been the division's chief sales engineer. He is succeeded by F. KENWOOD JONES who joined the company in 1940. Mr. Jones has since then been associated with grinding machines and equipment.

BACON FELT CO., Taunton, Mass., has added a 10,000-square-foot plant to its existing manufacturing facilities. This is the second major extension undertaken in the last four years. The firm's production area now exceeds 60,000 square feet.

NAPIER B. CALDWELL has been made sales manager for the Boston, Mass., plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill. JOSEPH A. MORAN succeeds Mr. Caldwell as manager of the tubular products and cold-finished steel bar sales.



Napier B. Caldwell, sales manager, Boston, Mass., plant of Joseph T. Ryerson & Son, Inc.

O. S. WALKER CO., INC., Worcester, Mass., has acquired the business of manufacturing and merchandising the Rawson coupling which for several years has been made and sold by the Washburn Shops at the Worcester Polytechnic Institute. The newly acquired business will be carried on as the Rawson Coupling Division of the company.

VAN NORMAN CO., Springfield, Mass., has acquired the Insuline Corporation of America, located at Manchester, N. H. The company's name will be changed to Van Norman Industries, Inc.

Edward J. Ferris, general superintendent of the Machine Tool Division of Pratt & Whitney Co., Inc.

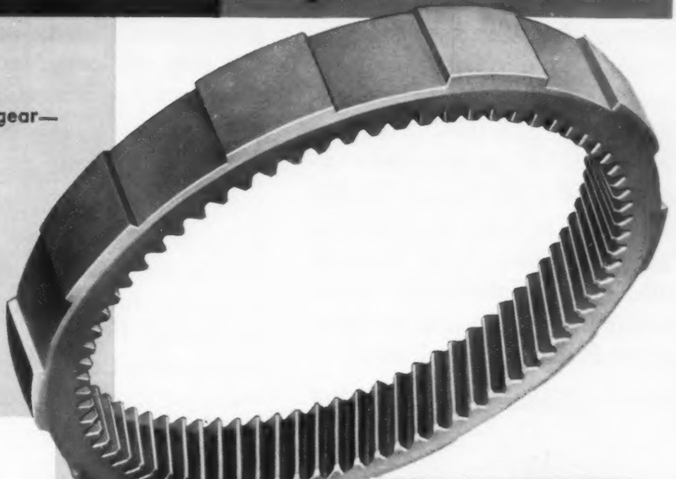
PRATT & WHITNEY CO., INC., West Hartford, Conn., announces the following appointments: EDWARD J. FERRIS has been made general superintendent of the Machine Tool Division. He has been associated with the firm for thirty-two years. Mr. Ferris succeeds A. L. KNAPP, who was recently named vice-president of the company and manager of its Machine Tool Division. JOSEPH H. RINEHART, JR. has been made sales engineer of the Cutting Tool and Gage Divisions with headquarters in Springfield, Ohio. CHARLES G. MCPARTLAND has been named cutting tool engineer for the West Coast area with headquarters in the company's Los Angeles, Calif., office. CLIFFORD A. BROOKS has been named advertising manager, succeeding VAS L. HOWE, who has resigned.

R. S. PETTIGREW & CO. has been named sales engineering representative in the New England territory by E. H. TITCHENER & CO., Binghamton, N. Y. Sales representation will include all of New England except western Massachusetts and headquarters will be in West Hartford, Conn.

S. S. PRICE has been made manager of panel-board and motor-control design engineering for the General Electric Co., Plainville, Conn., and A. H. ADAMS has been appointed manager of switchboard and distribution center design engineering.

(This section continued on page 254)

Broach Your Helical Transmission Gears *and Cut Your Costs*



This is a 73 tooth automatic transmission gear—5.5853 P.D., 14 pitch, 20° pressure angle.

It is broached in just one pass. A single shaving operation completes it.

All critical dimensions including lead and concentricity are held to extremely close tolerances.

Broaching time	25 Seconds, **floor to floor**
Shaving time	40 Seconds, **floor to floor**
Total machining time	65 Seconds

The 7 foot Naloy Broach used also chamfers the gear tooth edges as it cuts the teeth.

The constant and intimate contact Red Ring engineers have with advanced gear practice gives them a very real advantage in the design and production of gear tooth broaches.

Write **for specific suggestions on your broaching operations.**

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH AND MACHINE CO.
5600 ST. JEAN . . . . DETROIT 13, MICHIGAN
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

For more information on products advertised, use Inquiry Card, page 231

Bremen Bearings, Inc., uses SUPERLA Soluble Oil to give bearings the clean, cool treatment

PRECISION NEEDLE BEARINGS are the exclusive product of Bremen Bearings, Inc., Bremen, Indiana. SUPERLA Soluble Oil is used exclusively in all eight of the Company's Cincinnati Centerless Grinders. Plant management experimented with various soluble oils before settling on SUPERLA. They found none could compare with SUPERLA Soluble Oil with respect to wheel loading, stability and tool machine cleanliness.

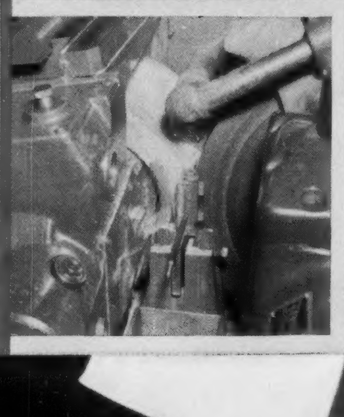
Plus these benefits, Bremen found SUPERLA mixed readily with water regardless of degree of hardness. The Company found, too, that they got longer tool life and maximum rust protection of work and machines.

You will have the same experience with SUPERLA Soluble Oil. Find out. Inquire of your Standard Oil lubrication specialist. In the Midwest call your nearby Standard Oil office. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Ill.

STANDARD OIL COMPANY (Indiana)

Franklin D. Clark (right), Sales Manager, Bremen Bearings, Inc., and Standard Oil lubrication specialist E. A. Hunt, inspect needle bearing. Gene Hunt is well qualified to assist industrial plants on lubrication problems. In addition to his three years' experience in industrial lubrication sales work, Gene has an M. E. degree from Purdue and has completed the Standard Oil Sales Engineering School. Customers find this experience and training pay off *for them*.

Bearings being ejected from Cincinnati Centerless Grinder at Bremen Bearings, Inc. The Company manufactures needle bearings to customers' specifications in sizes from 1/16 to 1/2 inch with tolerances of .0001" and finishes to 3 micro-inches. SUPERLA Soluble Oil is used on all of the Company's grinders.



AMERICAN STANDARD KNURLING—11

Table 2. *(Continued)* Diagonal and Diamond Knurling Produced by Straight Tooth Cylindrical Knurls

No. of Teeth On Work	Theoretical Blank Diameter on Which Standard Pitch Knurls May be Expected to Track*																			
	Angle Between Axis of Work and Knurl Axis																			
	25 Deg.				30 Deg.				35 Deg.				40 Deg.				45 Deg.			
	64*P*	96*P*	128*P*	160*P*	64*P*	96*P*	128*P*	160*P*	64*P*	96*P*	128*P*	160*P*	64*P*	96*P*	128*P*	160*P*	64*P*	96*P*	128*P*	160*P*
115			0.991	0.793				0.830				0.877				0.938				
116			1.000	0.800				0.837				0.885				0.946				
117			1.008	0.807				0.844				0.893				0.955				
118				0.814				0.852				0.900				0.963				
119				0.821				0.859				0.908				0.971				
120				0.828				0.866				0.916				0.979				
121				0.834				0.873				0.923				0.987				
122				0.841				0.880				0.931				0.995				
123				0.848				0.888				0.938				1.003				
124				0.855				0.895				0.946								
125				0.862				0.902				0.954								
126				0.869				0.909				0.961								
127				0.876				0.917				0.969								
128				0.883				0.924				0.977								
129				0.890				0.931				0.984								
130				0.896				0.938				0.992								
131				0.903				0.945				1.000								
132				0.910				0.953												
133				0.917				0.960												
134				0.924				0.967												
135				0.931				0.974												
136				0.938				0.981												
137				0.945				0.989												
138				0.952				0.996												
139				0.959																
140				0.965																
141				0.972																
142				0.979																
143				0.986																
144				0.993																
145				1.000																

*Modifications of these diameters may be required in order to suit various knurling conditions, such as materials and variations in practice.

Extracted from ASA B5.30-1953 with permission of publisher, American Society of Mechanical Engineers.

AMERICAN STANDARD KNURLING—12

Table 3. Preferred Sizes for Cylindrical Type Knurls

Nominal Outside Diameter, Inches D_{nt}	Width of Face, Inches F	Diameter of Hole, Inches A	Number of Teeth for Standard Diametral Pitches N: 64P	96P	128P	160P
1/2	3/16	3/16	32	**48**	64	80
5/8	1/4	1/4	40	**60**	80	100
3/4	3/8	1/4	48	**72**	96	120
7/8	3/8	1/4	56	**84**	112	140
ADDITIONAL SIZES FOR BENCH AND ENGINE LATHE TOOL-HOLDERS						
5/8	5/16	7/32	40	60	80	100
1	3/8	5/16	64	96	128	160

Table 4. Specifications for Straight and Diagonal Tooth Cylindrical Knurls

Diametral Pitch P	Nominal Diameter of Knurl,* Inches: 1/2	5/8	3/4	7/8	1	Tracking Correction Factor Q	Tooth Depth, Inches Tolerance +0.0015 −0.0000: Straight	Diagonal†	Radius at Root, Inches	Approximate Space between Sides of Adjacent Teeth, Degrees: Straight	Diagonal†	Eccentricity of Teeth, Inches (Total Indicator Reading) Maximum
	Major Diameter of Knurl, Inches Tolerance +0.0000, −0.0015											
64	0.4932	0.6165	0.7398	0.8631	0.9864	0.0006676	0.024	0.021	0.0070 0.0050	80	80	0.002
96	**0.4960**	**0.6200**	**0.7440**	**0.8680**	**0.9920**	**0.0002618**	**0.016**	**0.014**	**0.0060** **0.0040**	**80**	**80**	**0.002**
128	0.4972	0.6215	0.7458	0.8701	0.9944	0.0001374	0.012	0.010	0.0045 0.0030	80	80	0.002
160	0.4976	0.6220	0.7464	0.8708	0.9952	0.00009425	0.009	0.008	0.0040 0.0025	80	80	0.002

*The different nominal diameters of knurls are used to meet established requirements of tool-holders, machine sizes, and the contour of the work.
†With 30-degree helix angle.
Note: Number of teeth = diametral pitch × nominal diameter.

Table 5. Specifications for Flat Knurling Dies

Diametral Pitch P	Linear Pitch, Inches P_l*	Tooth Depth, Inches h	Radius at Root, Inches R	Diametral Pitch P	Linear Pitch, Inches P_l*	Tooth Depth, Inches h	Radius at Root, Inches R
64	0.0484	0.024	0.0070 0.0050	128	0.0244	0.012	0.0045 0.0030
96	0.0325	0.016	0.0060 0.0040	160	0.0195	0.009	0.0040 0.0025

*The linear pitches shown in the table are theoretical. The exact linear pitch produced by a flat knurling die may vary slightly from the figures in the table, depending upon the rolling condition and the material being rolled.

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Ernest F. Hennis, district sales manager in the New Jersey area for Bryant Chucking Grinder Co.

BRYANT CHUCKING GRINDER CO., Springfield, Vt., announces the following changes: ERNEST F. HENNIS has been appointed district sales manager, and L. GRAHAM COLLINS, sales representative in the New Jersey area. N. A. LEYDS, formerly district sales manager in the New York district, has been transferred to Springfield, Vt., as assistant sales manager.

New York and New Jersey

A. I. AALTO has been named manager of plant facilities of Alco Products, Inc., Schenectady, N. Y., where he will be responsible for facility engineering and requirements for the manufacturing plants, offices, warehouse, and property of the entire company. He will continue to maintain his office at Schenectady. Mr. Aalto joined the company in 1951 as a tool engineer and subsequently held the positions of supervisor of tool design, assistant supervisor of production, and supervisor of machinery and tool design. He succeeds J. E. Currie, who died recently.

CARBORUNDUM COMPANY, Niagara Falls, N. Y., will spend one and one-half million dollars to modernize and expand its "Monofrax" Refractories plant in Falconer, N. Y. The expansion program will be accomplished in progressive stages during the next five years. The building schedule calls for completion in 1956 of a new building for storage and handling of raw materials and other supplies. A. L. DONNENWIRTH is manager of the Falconer plant which is a unit of the Refractories Division of the Carborundum Company.

DR. LAUCHLIN M. CURRIE has been appointed a vice-president of Union Carbide Nuclear Co., division of Union Carbide & Carbon Corporation, New York City. Dr. Currie joined the company in 1925. Subsequently he was given administrative positions in both research and production with National Carbon and also Bakelite Co., another division of the corporation.

ENGELBERG HULLER CO., Syracuse, N. Y. announces the following representatives for their expanded line of abrasive belt machines: Do-All Eastern Co., Inc., and the Morey Machinery Co., both of New York City, who will serve the greater New York area.

GERARD Q. DECKER has been made division manager of the Eastern Division of Servomechanisms, Inc., Westbury, N. Y. He replaces HAROLD E. CARLSON, who has been appointed to the executive office staff as program controller.

PHILLIPS SCREW CO., New York City, announces the following promotions: C. M. CAMBERN has been elected chairman of the board; and JUDSON B. SHAFER has been made president and general manager.

BUFFALO FORGE CO., Buffalo, N. Y., announces the following executive appointments: WILLIAM R. HEATH has been elected executive vice-president, having joined the company in 1922, with successive promotions to chief engineer in 1948, director of manufacturing in 1951, a director in 1952, and a vice-president in 1953; GEORGE P. SCHIVLEY has been appointed director of manufacturing, having begun his career in 1940 as works manager and subsequently becoming superintendent in 1942 and plant manager in 1951.

EVERETT N. SIEDER has been appointed marketing manager of thermal products for Alco Products, Inc., Schenectady, N. Y. Mr. Sieder will make his headquarters at Schenectady.

PARKER-KALON DIVISION, General American Transportation Corporation, New York City, announces the opening of its modern, one-story plant on a 14-acre site in Clifton, N. J. The total floor space is 267,000 square feet of which 225,000 square feet will be used exclusively for manufacturing. The entire plant has been designed and constructed on a flexible basis with knock-out walls so that the manufacturing area can be readily expanded to 350,000 square feet. Three types of materials handling equipment will be utilized in the plant—trucks, overhead monorails and cranes, and conveyors. The shipping facilities occupy 40,000 square feet. The plant incorporates a completely independent air-conditioned laboratory for research and development.

The UNITED STATES GASKET CO., Camden, N. J. and the BELMONT PACKING & RUBBER CO., Philadelphia, Pa., have announced consolidation of their product lines, sales organizations, and activities under the merchandising name of U. S. GASKET-BELMONT PACKING. HARRY STOTT, who headed sales for the United States Gasket Co., is general sales manager of the new combination.

CIRCULAR TOOL CO., INC., Providence, R. I., has appointed Eaton Co., Hackensack, N. J., as sales representative in the New York, New Jersey, and Connecticut area. The newly appointed concern will be under the direction of CHARLES E. EATON, president.

(Left) William R. Heath, executive vice-president, Buffalo Forge Co.; and (right) George P. Schivley, director of manufacturing

JOHN M. ANSPACH has been appointed manager of the foundry and pattern shop of the De Laval Steam Turbine Co., Trenton, N. J.

Ohio

GRAY IRON FOUNDRIES' SOCIETY, INC., Cleveland, Ohio, announces the election of the following executives: C. H. KER has been re-elected president; C. H. MEMINGER has been re-elected secretary; and W. O. LARSON has been re-elected treasurer. J. SCOTT PARRISH, JR., has been elected vice-president. New directors named for a three-year term are WILLIAM Z. TAYLOR, J. SCOTT PARRISH, JR., C. S. WIELAND, and A. H. RENFROW.

BRUSH ELECTRONICS CO., Cleveland, Ohio, announces the following appointments. JOHN H. HARRIS has been elected vice-president in charge of planning; and WALLACE T. GRAY has been appointed general works manager.

GENERAL BENJAMIN WILEY CHIDLAW, former commander-in-chief of United States Continental Air Defense Command, has been elected a member of the board of directors of the Sheffield Corporation, Dayton, Ohio.

TIMKEN ROLLER BEARING CO., Canton, Ohio, announces the following changes: EDGERLY W. AUSTIN, general manager of the Automotive Division has retired. He started with the company in 1919 as a field representative. Succeeding Mr. Austin is ROBERT G. WINGERTER who was formerly assistant general manager. He has been with the company since 1938.

Robert G. Wingerter, general manager, Automotive Division, Timken Roller Bearing Co.

D. M. Hallier, manager of cutting tools, Motch & Merryweather Machinery Co.

D. M. HALLIER has been made manager of cutting tools for both the Cutting Tool Distributor Division and the Cutting Tool Manufacturing Division of Motch & Merryweather Machinery Co., Cleveland, Ohio.

WARNER & SWASEY CO., Cleveland, Ohio, announces the following changes: RUSSELL L. HILL has become field engineer for the Philadelphia, Pa., sales office with headquarters at 6910 Market St., Upper Darby, Pa.; and EDWARD SHIPLER has taken up duties as field engineer at the East Orange sales office located at 19 N. Harrison St., East Orange, N. J.

ROBERT C. BAUMGARTNER has been made general sales manager of the Oster Mfg. Co., Cleveland, Ohio. In his new post, Mr. Baumgartner will direct all company sales and sales promotion activities.

WILLIAM A. ROTH, vice-president and former assistant general manager of Cleveland Pneumatic Tool Co., Cleveland, Ohio, has been named general manager to succeed VERN R. DRUM, who has recently retired.

CARL A. DRAKE has been appointed manager of the manufacturing engineering unit at the General Electric Company's laminated and insulating products department, Coshocton, Ohio.

WILLIAM J. FATH has been made production control manager of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

PERRY C. SMITH has been made manager of the equipment department of Brush Electronics Co., Cleveland, Ohio.

Warren G. Rosendahl, vice-president and sales manager, Nebel Machine Tool Corporation

NEBEL MACHINE TOOL CORPORATION, Cincinnati, Ohio, announces the appointment of WARREN G. ROSENDAHL as vice-president and sales manager.

L. L. SHAFFER has been promoted to branch manager in charge of the Cincinnati, Ohio warehouse and office by J. N. Fauver Co., Inc., Detroit, Mich. He will serve southern Ohio, Kentucky, and southeastern Indiana.

JAMES F. RAFFERTY has been elected vice-president and general manager of Pneuma-Serve, Inc., Cleveland, Ohio.

Pennsylvania and Virginia

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh, Pa., announces the following appointments: JAMES H. BECHTOLD has been named manager of the metallurgy department of the Westinghouse Research Laboratories; HARVEY T. HARROD has been made manager of government contract administration for the Electronic Tube Division, Elmira, N. Y.

C. EUGENE SILVER has been appointed sales representative for the Herman Pneumatic Machine Co., Pittsburgh, Pa. Mr. Silver's territory will include Texas, Louisiana, and Oklahoma. His office is located at 1214 Sterrett St., Houston, Tex.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., has announced the opening of a melting department for the production of high-alloy steel that offers 250,000 pounds per month of high-performance alloys to the metal-working industry.

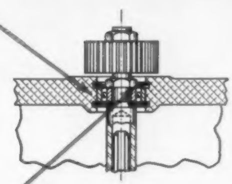
(*This section continued on page* 260)

4 Waldes Truarc Rings Cut Costs Drastically, Increase Versatility of Precision Automatic Drill

Dumore's New Automatic Drill

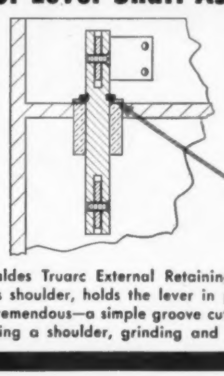
Dumore Precision Tools, Racine, Wisconsin, uses 4 Waldes Truarc Retaining Rings in their versatile new automatic drill unit. Machining operations have been eliminated, assembly simplified. Great labor savings have resulted from use of Truarc rings.

Drive Spindle Assembly



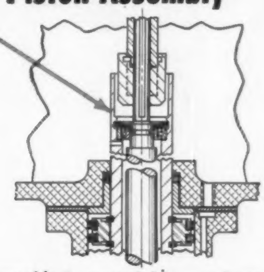
Bearing is held in position by two Waldes Truarc Rings—Standard (Series 5000) and Bowed (Series 5001). Two grooves are turned and housing rough bored in one operation. Alternate method would require at least two additional machining operations. Bowed Truarc ring takes up accumulated tolerances resiliently.

Actuator Lever Shaft Assembly



A Single Waldes Truarc External Retaining Ring (Series 5100) acts as shoulder, holds the lever in position. Labor savings are tremendous—a simple groove cutting operation replaces turning a shoulder, grinding and polishing.

Piston Assembly



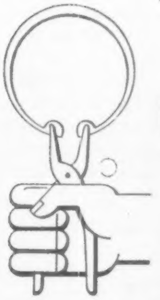
Easy assembly is assured by use of one Waldes Truarc Bowed Ring (Series 5001) to lock the bearing to the piston assembly. When unit is to be used in tapping applications, entire spindle assembly can be removed without disassembly.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product...to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types...as many as 97 different sizes within a type...5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U.S.A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.

For precision internal grooving and undercutting . . . Waldes Truarc Grooving Tool!



Send for new catalog supplement

WALDES TRUARC® RETAINING RINGS

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.

(Please print)

Name..........

Title..........

Company..........

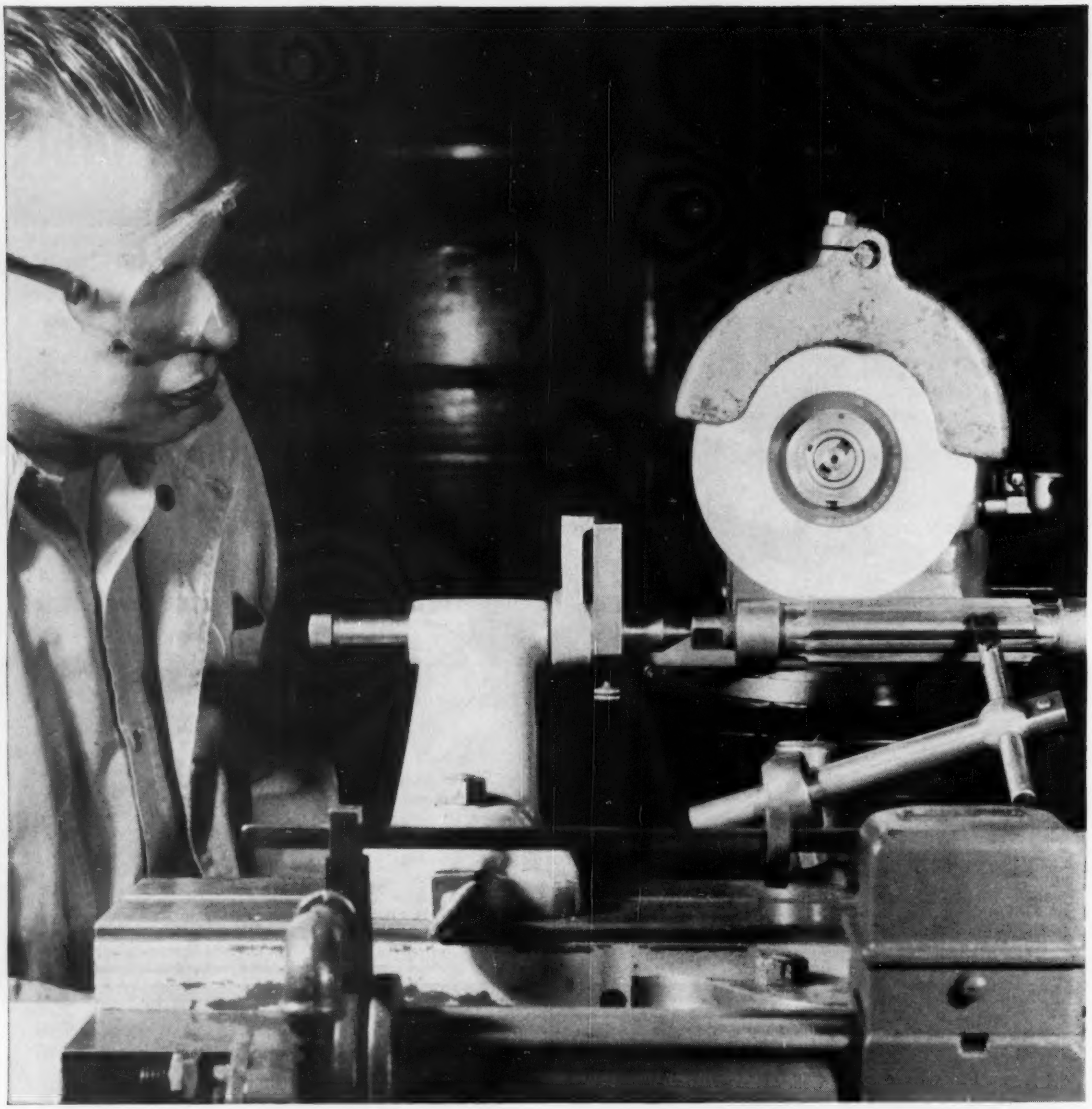
Business Address..........

City.......... Zone...... State..........

M127

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

For more information on products advertised, use Inquiry Card, page 231



From start to finish with **ONE** *set-up...*

ASK YOUR CARBORUNDUM DISTRIBUTOR or salesman for a demonstration of these outstanding new wheels in your own shop, on your own tools. He's listed in the yellow pages of your phone book under "Abrasives" or "Grinding Wheels" and offers expert counsel plus fast, dependable service on all your grinding needs.

FREE FOLDER AND WALL CHART! Gives recommended V40 wheel gradings for grinding high speed tool and die steels. Write The Carborundum Company, Dept. M 81-56, Niagara Falls, N. Y. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ont.

use V40 bond TOOL ROOM WHEELS

HOLDS FORM, YET EASY TO DRESS! Here's the tool room wheel that does *more work* more of the time than any other wheel you can use. The superior form-holding ability of V40 eliminates costly stops for wheel dressing and re-setting-up halfway through a job. Yet...when dressing between jobs, the special vitrified bond composition permits faster, easier dressing—with substantial savings in diamonds, time and abrasive.

COOLER, FASTER CUTTING! V40 Bond Wheels cut exceptionally cool and free, even on high speed steels and hi-vanadium types. They are available in every type of wheel (straight, recessed, straight cup, flaring cup, dish, saucer) for every tool room grinding operation.

EASY TO IDENTIFY, EASY TO ORDER! Pure white aluminum oxide grain and the bright red blotter give V40 wheels a distinctive appearance. They're easy to order, too...you can usually specify V40 Bond Wheels in the same grit and grade as wheels you are now using.

CARBORUNDUM

REGISTERED TRADE MARK

...continually putting more **SENSE** *in your abrasive* **DOLLAR**

For more information on products advertised, use Inquiry Card, page 231


(Left) Samuel H. Greenwood, field sales manager of F. J. Stokes Machine Co., Inc., and (right) Fred Hillsley, district manager of Philadelphia territory

F. J. STOKES MACHINE CO., INC., Philadelphia, Pa., announces the following promotions: SAMUEL H. GREENWOOD has been made field sales manager. In his new position he will direct all local sales activities in the United States and Canada, and will supervise the operations of the ten district offices. He joined the organization in 1949. FRED HILLSLEY has been appointed to succeed Mr. Greenwood as district manager of the Philadelphia territory. He joined the organization in September 1953 as a sales engineer.

RALPH E. CAMPBELL has been appointed district manager of the Pittsburgh, Pa., office of SKF Industries, Inc., Philadelphia, Pa., while J. H. SUTHERLAND has been named district manager of the Chicago, Ill., office.

DONALD J. NEWMAN has been appointed to the position of labor relations administrator of Crucible Steel Company of America, Pittsburgh, Pa.

WESLEY R. SUTTON has been made assistant chief engineer of the Carbide Sales Division of Firth Sterling, Inc., Pittsburgh, Pa.

WILLIAM R. BUTLER has been appointed manager of die-casting sales of the Aluminum Company of America, Pittsburgh, Pa.

JULIAN M. PASICK (whose name was incorrectly given as Julian M. Paxick in November MACHINERY) is general manager of the MACHINE TOOLS AND SPECIAL MACHINERY SUPPLY CO., Cincinnati, Ohio, recently appointed representative of the ERIE FOUNDRY CO., Erie, Pa., for both forging and hydraulic machinery in southern Ohio and West Virginia.

J. HEBER PARKER, chairman of the board of Carpenter Steel Co., Reading, Pa., has been re-elected a director of the National Industrial Conference Board for a one-year term.

EDWARD O. EDNEY, JR. has been appointed project manager for the nuclear power program for Westinghouse Electric Corporation, Steam Division, South Philadelphia, Pa.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces that the multi-million-dollar plant near Roanoke, Va., is nearing completion. The plant of more than 600,000 square feet will house manufacturing and office facilities for the company's industry control department, with headquarters in Schenectady, N. Y.

Tennessee, Georgia, and Washington, D.C.

HUBBELL METALS, INC., St. Louis, Mo., has announced the opening of a plant at 484 S. Front St., Memphis, Tenn. HOWARD BROEMMELSICK is manager of the new Memphis plant. SIDNEY T. WRIGHT, formerly with sales at Hubbell's Indianapolis plant, has also been assigned to Memphis.

WILLIAM HENLEY, Atlanta, Ga., has been appointed manufacturers' representative of Barry Controls, Inc., Watertown, Mass. His territory includes Tennessee, Mississippi, Georgia, Alabama, Florida, South Carolina, and North Carolina.

T. COOLIDGE SHERMAN has been appointed as Washington, D. C., representative for the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. He succeeds Harold N. Arbuthnot who died recently.

Canada

WESSON CO., Detroit, Mich., announces the expansion of its Canadian operations with the opening of a new division in Toronto, Ontario. The division, called Wesson Cutting Tools, Ltd., is located at 93 Leicester Ave. in Toronto. It will be headed by H. B. IRON, president, and L. P. CHAPMAN, vice-president in charge of sales.

Obituary

CARL E. PAULSEN died recently at the age of fifty-seven years. He was one of the original organizers of the Detroit Broach Co., Detroit, Mich., where he served as plant superintendent and vice-president for many years and more recently in a consulting capacity. He is survived by his wife and daughter.

Coming Events

MARCH 19-23, 1956—Industrial Exposition sponsored by the AMERICAN SOCIETY OF TOOL ENGINEERS to be held at the International Amphitheatre, Chicago, Ill. For further information write to Harry Conrad, executive secretary, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.

MAY 9-11, 1956—National Spring Technical Meeting, and Welding and Allied Industry Fourth Exhibition of the AMERICAN WELDING SOCIETY will be held at Memorial Auditorium, Buffalo, N. Y. For further information write to the American Welding Society, Inc., 33 W. 39th St., New York 18, N. Y.

MAY 14-17, 1956—First Design Engineering Show will be held at Convention Hall, Philadelphia, Pa. For further information write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

* * *

Annual Index to MACHINERY

The annual index to Volume 61 of MACHINERY (September, 1954, to August, 1955, inclusive) is now ready for distribution. Subscribers who have not previously requested copies can obtain them without charge by writing to MACHINERY, Circulation Department, 93 Worth St., New York 13, N. Y.

* * *

Lifting and carrying by manual labor costs approximately \$10.00 per horsepower-hour, as compared to less than \$0.03 by electrically operated conveyors.

For more information on products advertised, use Inquiry Card, page 231

For more information on products advertised, use Inquiry Card, page 231

How Correct Lubrication cured it—saved over $8,000 a year!

It was almost as if some superhuman hand were holding it back, preventing the massive 5-ton table from moving smoothly on its ways—causing it first to stick and then jump forward erratically.

This trouble happened in a plant using a huge hydraulic surface grinder for rough and precise finishing of parts for home power saws. To obtain precise finishes, table speed had to be reduced; but whenever this was done the table jumped, resulting in poor finish and excessive rejects. To overcome table jumping, the operators *tripled* hydraulic pressure in the machine. This caused failure of tubing and fittings, increased wear, shut down the grinder an average of 10 hours a week!

A Socony Mobil man discovered this trouble while providing engineering service to this plant. After studying the grinder, he recommended using a special Gargoyle oil for table way lubrication. This cured the table sticking and jumping. Hydraulic pressure was reduced to normal. The plant is now saving $8,000 a year on production alone—has cut maintenance costs drastically!

★ ★ ★

A program of Correct Lubrication entitles you to this same kind of lubrication engineering service. Use it in *your* plant to improve production—cut costs!

SOCONY MOBIL *Correct Lubrication*

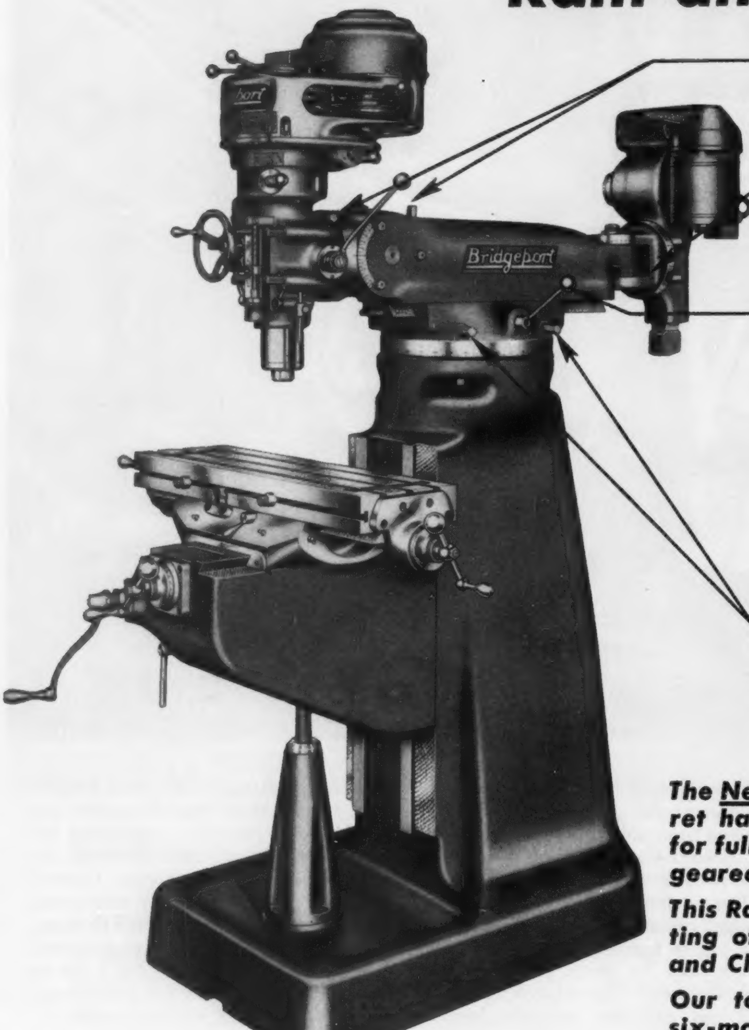
FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.
Formerly Socony-Vacuum Oil Company, Inc.

For more information on products advertised, use Inquiry Card, page 231

INVESTIGATE . . .

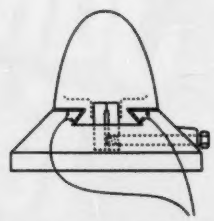
the NEW *Bridgeport* Ram and Turret



WORM GEAR ADJUSTMENTS for setting head at angles in two planes or combination of same.

STANDARD SWIVEL ADAPTER makes it possible to set Shaping or Cherrying Attachments at angles.

RACK AND PINION CONTROL for in or out movement of Ram.



NEW (pat. pending) EXPANDING DOVETAIL LOCK binds all four surfaces together giving vibrationless performance.

The New BRIDGEPORT Ram and Turret has been designed and tested for full utilization of the 1 HP back-geared BRIDGEPORT Milling Head.

This Ram permits full universal setting of the Milling Head, Shaping and Cherrying Attachments.

Our toolmakers prefer it after a six-month test.

We are sure you will like it.

Bridgeport **MACHINES, INC.**

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

For more information on products advertised, use Inquiry Card, page 231

New COST-SAVING "COMBINATION"

for certified efficiency—easy maintenance —and unlimited adaptability

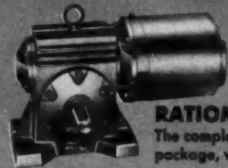
The new 100 SERIES RATIOMOTOR combines a gear reduction unit and an easily detachable, standard end-mounted motor.

MOTOR CAN BE REMOVED and replaced in a few minutes, without disturbing the gear reduction unit. Saves maintenance time, preserves alignment, permits continued operation with spare motor.

ORIGINAL MOTOR CAN BE CHANGED When conditions require change to a motor of special characteristics (totally enclosed, explosion-proof, etc.) it can easily be attached in place of the original motor.

ANY MODEL NEEDED – FROM STOCK The 100 SERIES includes 1064 different *standardized stock* units for an unlimited range of applications . . . Reductors, for mechanical drives, as well as Ratiomotors and Flanged Reductors. All ratings are *certified* to be actual torque delivered, by Independent Laboratory tests.

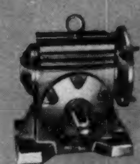
A BOSTON GEAR FIELD ENGINEER will help you simplify planning, and put your product ahead in design. Your Boston Gear Distributor will arrange a call, or write: Boston Gear Works, 65 Hayward St., Quincy 71, Mass.

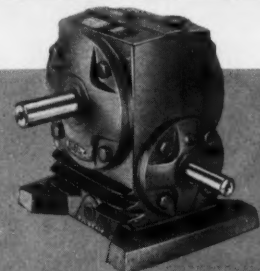


RATIOMOTORS
The complete power package, with motor.

SOLD WITH OR WITHOUT MOTOR

FLANGED REDUCTORS
The Ratiomotor gear unit, supplied without motor. You buy and attach any motor you choose.





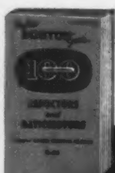
REDUCTORS
For mechanical drives, new 100 SERIES design saves space and weight. Housings are finned for improved cooling. Fan-cooling optional on larger sizes.

MAXIMUM HORSEPOWER PER DOLLAR
Certified
by Independent Laboratory tests

PATENTS PENDING

GET NEW CATALOG R-56

Lists models for any drive . . . horizontal or vertical—right angle or parallel—single or double reduction. Includes selection charts, engineering data.



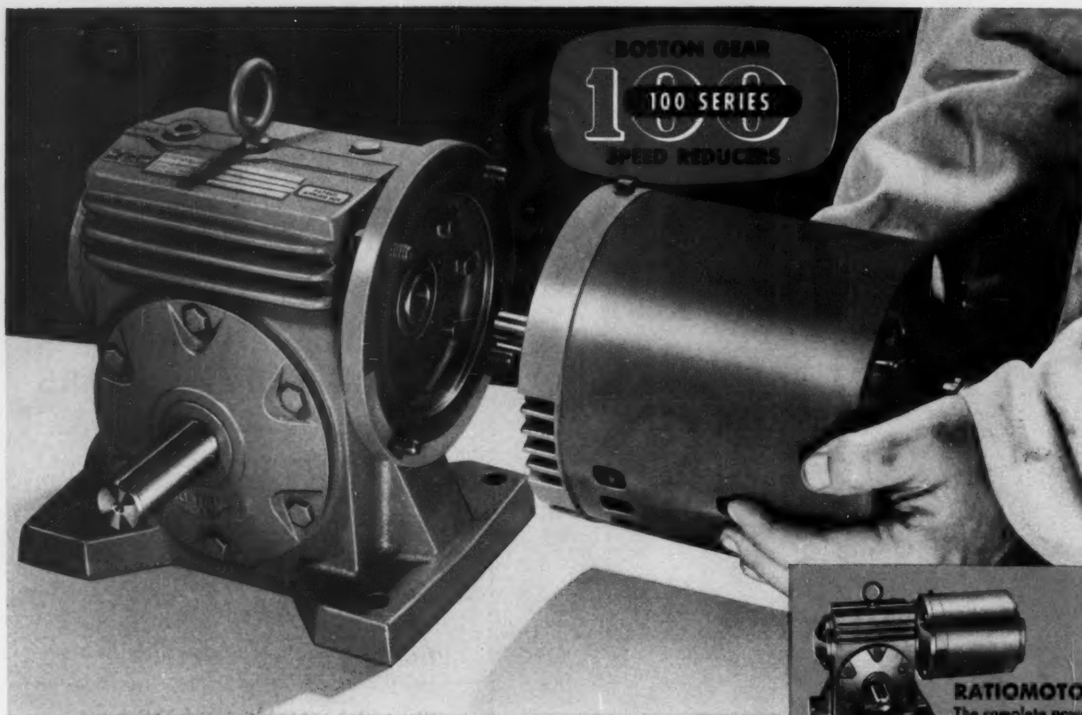
1064 DIFFERENT UNITS
108 MODELS – FROM *STOCK*

Call your **BOSTON** *Gear*® **DISTRIBUTOR**

For nearest distributor, look under "GEARS" in the Yellow Section of your Telephone Directory.

55-BG-R-17A

For more information on products advertised, use Inquiry Card, page 231



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The complete power package, with motor.

SOLD WITH OR WITHOUT MOTOR

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The Ratiomotor gear unit, supplied without motor. You buy and attach any motor you choose.

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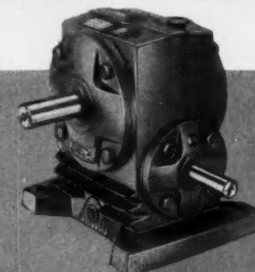

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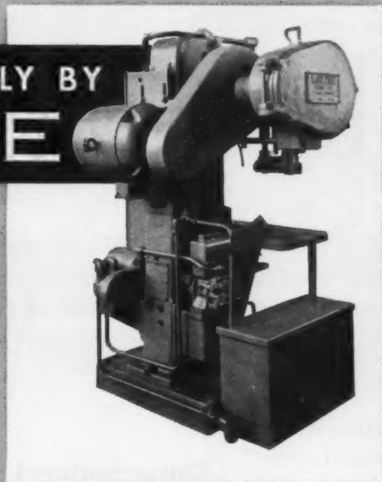
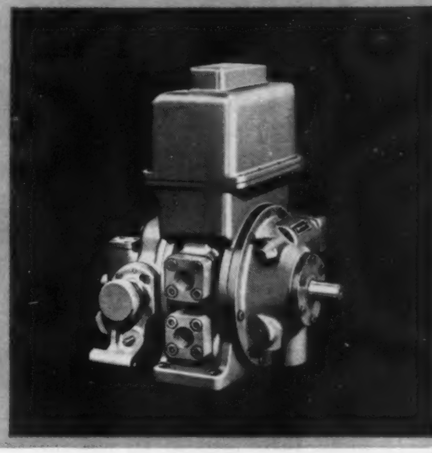
55-BG-R-17A

For more information on products advertised, use Inquiry Card, page 231

OILGEAR "JK" FEED PUMPS

USED EXTENSIVELY BY MOLINE



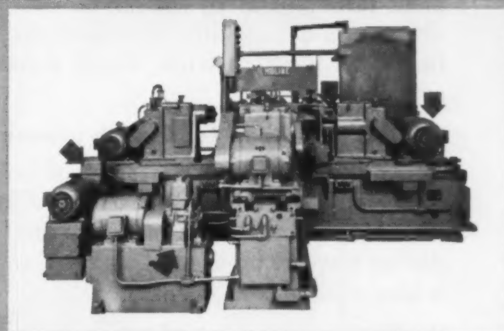


Above, Moline Drilling Machine employing "JK" Feed Pump.

The Moline Tool Company, long established and respected in industry, has used Oilgear Fluid Power Feeds since 1925. Of Oilgear "JK" Fluid Power Feed Pumps used in its machines, Moline says these pumps *combine* the advantages found only in part in various mechanical feeds. Also, the "JK" Feed Pump provides infinitely, steplessly variable speeds; you can easily find the speed best suited to the work or condition of tools. Traverse speed can be as much as 265 times the feed rate. Coarse and fine feed rates are variable over a 20 : 1 range. Cycle time is cut drastically, production increased, costs reduced. Feed rates are maintained accurately despite varying work pressures by a built-in automatic pressure compensator.

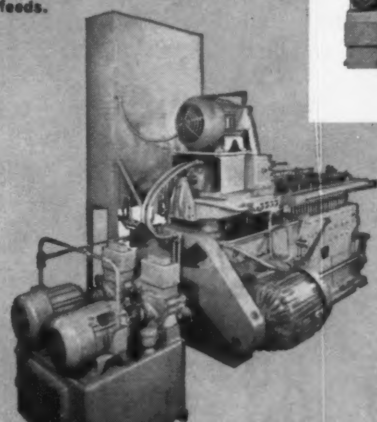
"JK" Feed Pumps are simple, compact, electro-hydraulically controlled units, easily installed nearby or remotely. Systems need only a pump with reservoir, a double-acting cylinder, standard control and two easily connected pipes. Eliminating expensive engineering, these units can simplify design, reduce manufacturing cost, improve performance and increase saleability of machines. Manual, semi-automatic or full automatic operation. Available now in 4 sizes. Write for free literature.

THE OILGEAR COMPANY
1569 West Pierce Street
Milwaukee 4, Wis.



Moline 4-way horizontal boring machine uses 4 Oilgear "JK" Feed Pumps.

Below, Moline special 56-spindle back-spotfacing machine using 2 "JK" units for vertical and horizontal feeds.

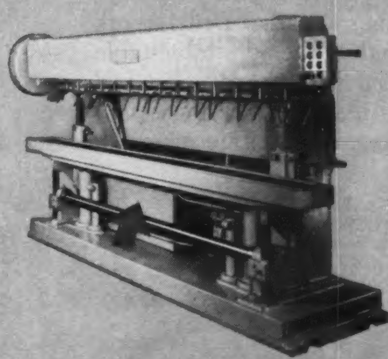


"JK" PUMPS EASILY APPLICABLE TO YOUR MACHINES FOR BETTER PERFORMANCE

JIC

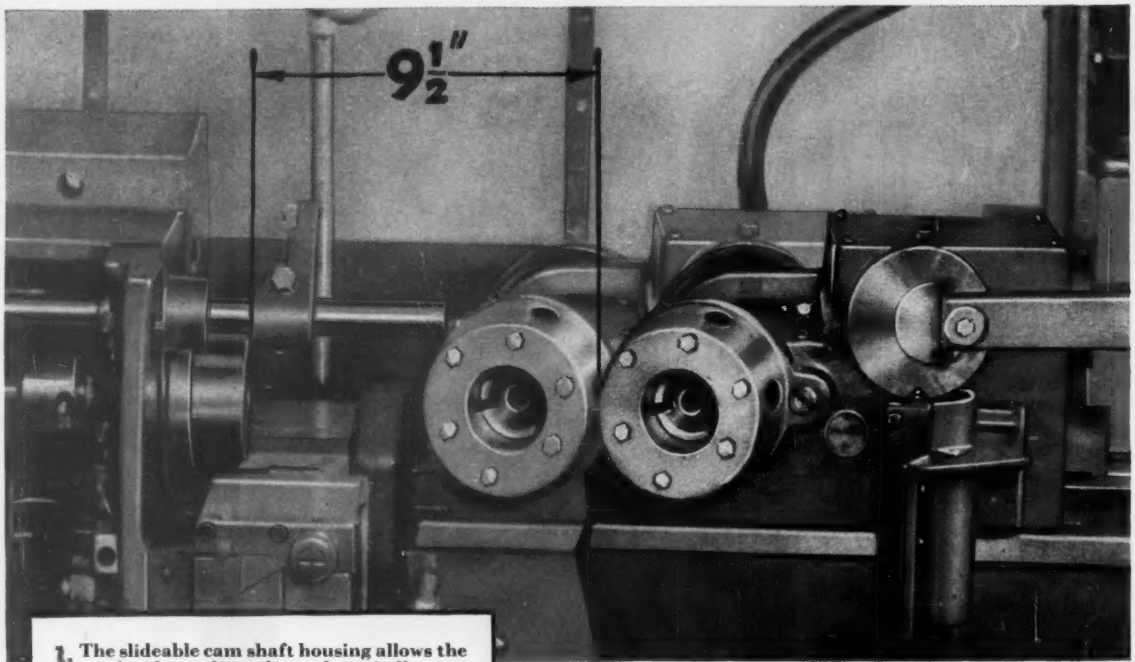
PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

Below, Moline ten-foot, straight-line drilling machine using "JK" Feed Pump.

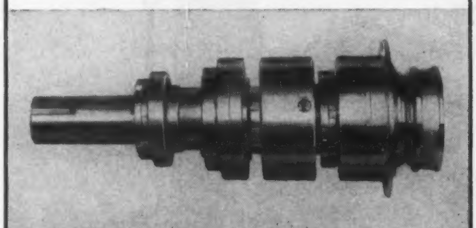


OILGEAR Fluid Power

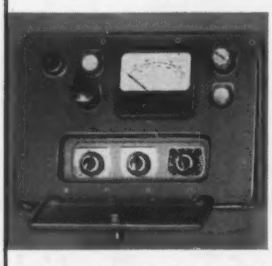
PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS AND VALVES



1. The slideable cam shaft housing allows the turret head to adjust from the spindle nose —2¼" to 9½". This offers you an extra long working capacity. Turret tools can work on end of stock feed-out up to 7".



2. The extra-rugged spindle, with preloaded angular contact double ball bearings at the nose, is designed to withstand high tool pressure. High production speeds and heavy tool loads are easily maintained. If you need additional diameter capacity—the machine will handle bar stock up to 1" with outside feed.



3. The machine is equipped with an "Adjusto-Spede" drive control by three potentiometer dials—just set and read. Each dial may be set from 100 to 5100 r.p.m. (higher speeds available on request). Each of the preselected infinitely variable speeds may be tripped in any time during the cycle. All speeds are reversible. An additional feature allows reversing up to 2500 r.p.m.

3 "extra capacity" reasons why the Detroit Screwmatic 750 is revolutionizing the screw machine industry

Among the many unique developments you'll find in the Detroit Screwmatic 750 are the 3 extra capacity features illustrated here. They offer you versatility in your screw machine production never before possible with a single spindle automatic. Why not investigate the many other advantages of the Detroit Screwmatic 750.

Write, wire or phone today for complete comprehensive information.

DETROIT ScrewMatic 750

A product of

THE GEAR GRINDING MACHINE CO.

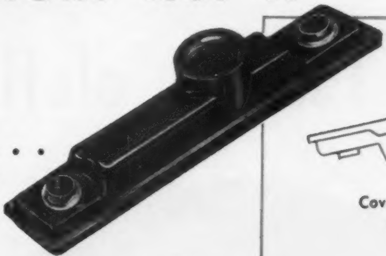
3921 Christopher • Detroit 11, Michigan

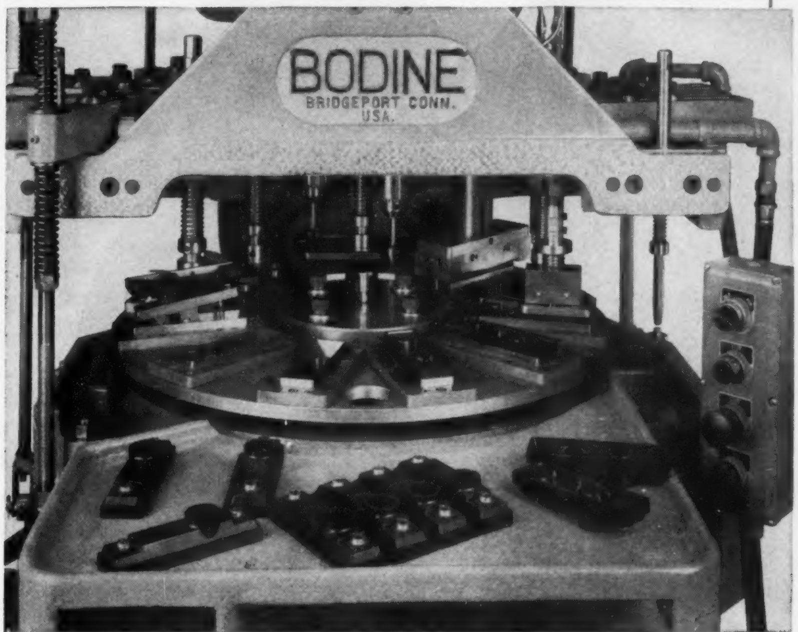
MANUFACTURERS OF: Fully Automatic Gear Grinding Machines • Rzeppa (pronounced "Sheppa") Constant Velocity Universal Joints.

For more information on products advertised, use Inquiry Card, page 231

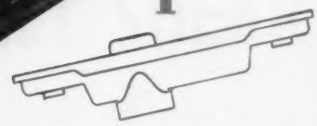
Bodine CASE HISTORY NO. 41

MULTIPLE OPERATIONS . . .
MULTIPLE TOOLING . . .
METAL AND PLASTIC . . .
ON ONE VERSATILE MACHINE



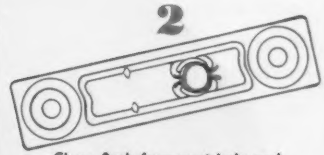


1



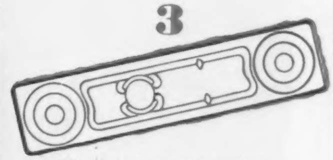
Covers hand-loaded, one piece per stroke.

2



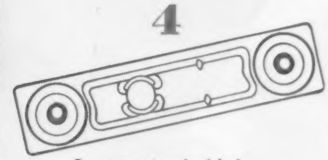
Clean flash from vent hole and slots. Carbide tools.

3



Trim flash from outside edges of cover. Carbide tools.

4



Ream two terminal holes in lead inserts.

5

Hollow-mill two terminals in lead inserts . . . using inverted spindles.

6

AUTO EJECT.

The unusual features of this Bodine tooling lie in the many different types of operations performed in one high-speed cycle, and also in the multiple tooling of the machine to handle many different sizes of these auto battery cell covers, both 6-volt and 12-volt.

Major battery producers now use 15 of these production units. Bodine basic design, as will be seen in the photograph, provides ample room for inclusion of the dies required for trimming operations, as well as the rotary spindles.

PRODUCTION: 1,250 covers per 50-minute hour . . . with machine operating at 25 strokes per minute.

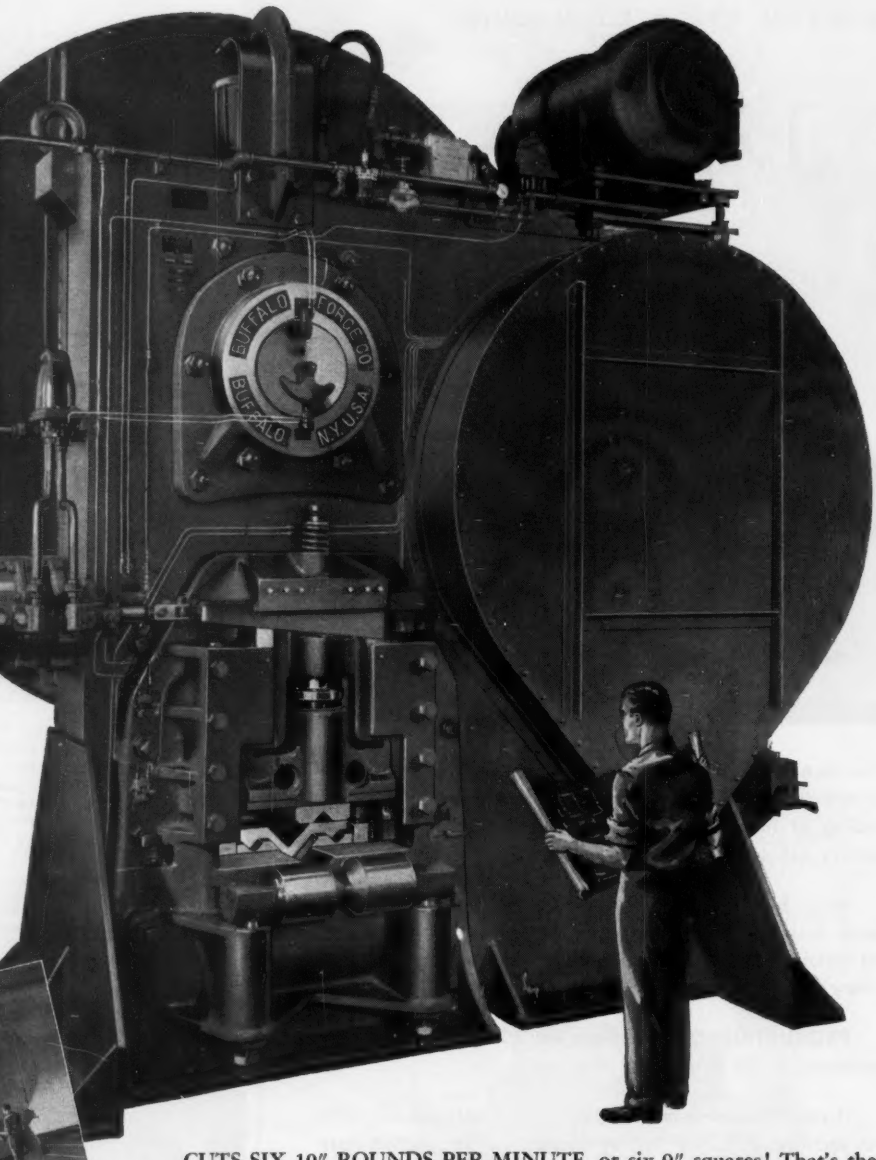
If you are looking for increased output at lower cost, without sacrifice of quality . . . on assembly or production operations, or a combination of both . . . talk to Bodine first. Our experience can save you money and costly engineering.

Write Dept. M-12

THE
Bodine
CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

7BD55

IF YOU'RE LOOKING FOR COSTS—



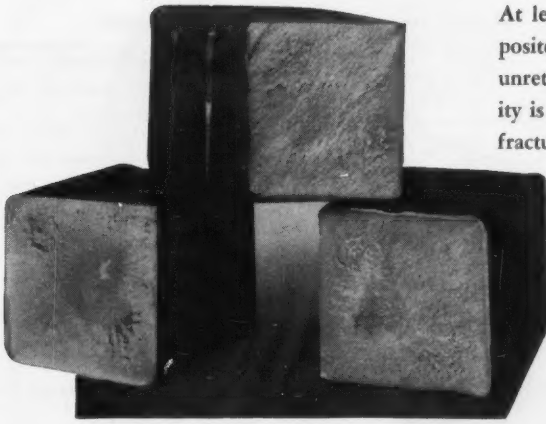
WRITE
FOR
BULLETIN
3295-C

CUTS SIX 10" ROUNDS PER MINUTE, or six 9" squares! That's the kind of speed the "Buffalo" No. 17 Billet Shear can put into your preparation of forging stock! The largest of 11 sizes, to meet a wide variety of requirements.

In all "Buffalo" products is the Q Factor—the built-in Quality which provides trouble-free satisfaction and long life.

LOWER METALWORKING

LOOK INTO "Buffalo" BILLET SHEARS



At left are 9" squares cut by a No. 17 Billet Shear (see opposite page). Note how clean and square the cuts are in this unretouched photo. Note the absence of "smearing"—porosity is not concealed to give you troubles later on. This shear-fracture method is your fastest and most accurate way of dividing billets for forging. High-production speeds range up to 30 strokes per minute on our smallest shear, which handles $2\frac{1}{4}$" rounds. Rigid, arc-welded steel plate frames, power feed lubrication, overall excellence of engineering make these machines equal to the toughest production runs. Check into these and "Buffalo" Bar Cutters by writing today for *Bulletin 3295-C.*

LOOK INTO "Buffalo" UNIVERSAL IRON WORKERS

Want a machine that will do *all these* jobs *without changing tools?*

1. Punch-slit-miter-shear flat bars
2. Cut-notch-cope-punch angles, tees, channels, I-beams and plates
3. Punch web and flange of channels and I-beams
4. Miter at 15°, 30°, 45°, (the only machine with instant miter settings)
5. Trim legs of angles
6. Cope angle legs (the only machine with independent notcher and coper)
7. Cut rounds, squares, reinforcing bars

Hundreds of these compact, powerful machines are doing the above operations in metalworking shops. All facts and capacities in Bulletin 360—your copy on request.

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO FORGE COMPANY

440 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING • PUNCHING • SHEARING • BENDING

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES

See Discs, Abrasive

ABRASIVES, HONING

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Macklin Co., 2925 Wildwood Ave., Jackson Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic

American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St. Ansonia, Conn.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Vickers Incorporated Division of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

AIR HOISTS—See Hoists, Air

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature

Firth Sterling Inc., 3113 Forbes St., Pittsburgh

ALLOYS, Non-Ferrous

American Brass Co., 25 Broadway, New York.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc

New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES

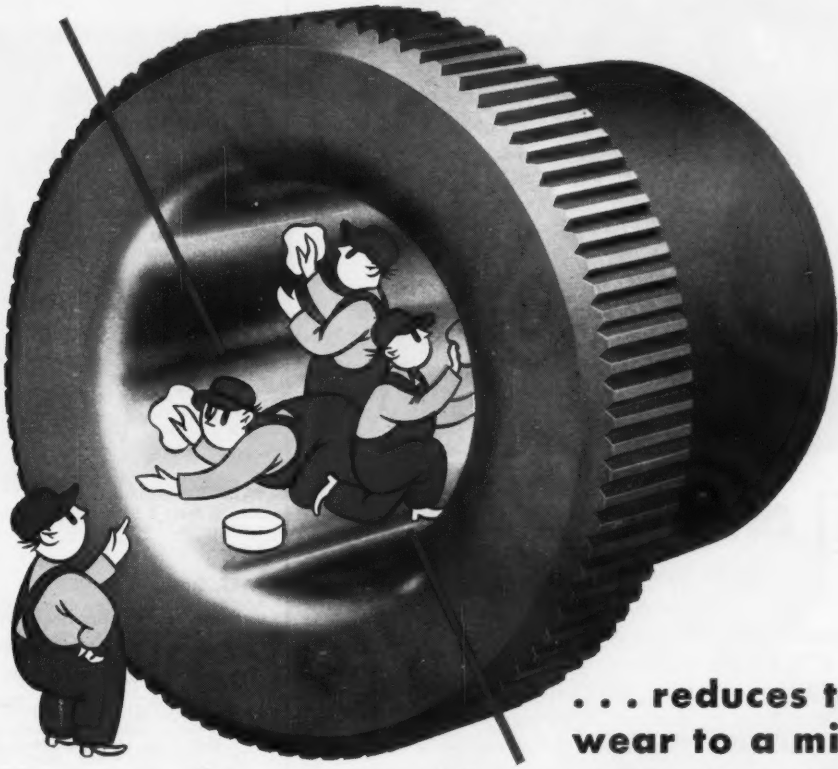
See Presses, Arbor

ARBORS AND MANDRELS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., Milwaukee, Wis.
Le Count Tool Works, Inc., 390-L Capitol Ave., Hartford, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(Continued on page 276)

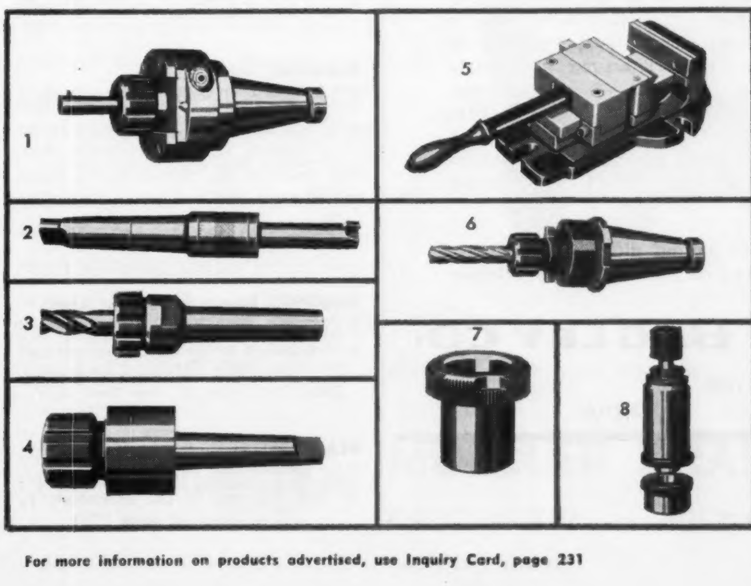
SUPER FINISH OF UNIVERSAL DRILL BUSHINGS . . .



. . . reduces tool wear to a minimum

One sure way to cut excessive tool wear in your operations is to specify Universal Drill Bushings because their superfinish bores help reduce wear on production tools to an absolute minimum, especially in close tolerance work. The blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy, uniform high quality and long life. Knurled heads provide a quick, sure grip. Universal Drill Bushings are produced in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N.J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

170



UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2 MICHIGAN

(1) BORING CHUCK
(2) MIKRO-LOK BORING BAR
(3) STANDARD COLLET CHUCK
(4) FLOATING COLLET CHUCK
(5) WEDGE-LOCK PRODUCTION VISE
(6) "KWIK-SWITCH" TOOL HOLDER
(7) STANDARD DRILL BUSHING
(8) UNIVERSAL INDEX PLUNGER

For more information on products advertised, use Inquiry Card, page 231

BABBITT

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALL BEARING TESTERS

Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BARS, Steel

Allegheney Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

BEARINGS, Lineshaft

Fafnir Bearing Co., New Britain, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

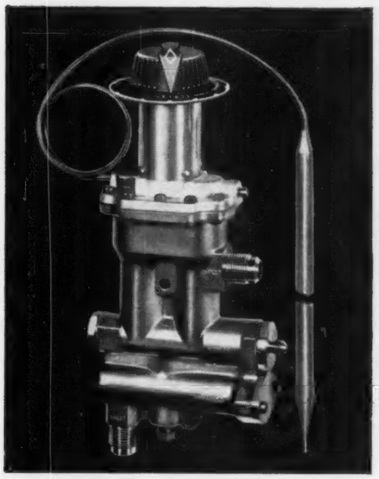
(Continued on page 278)

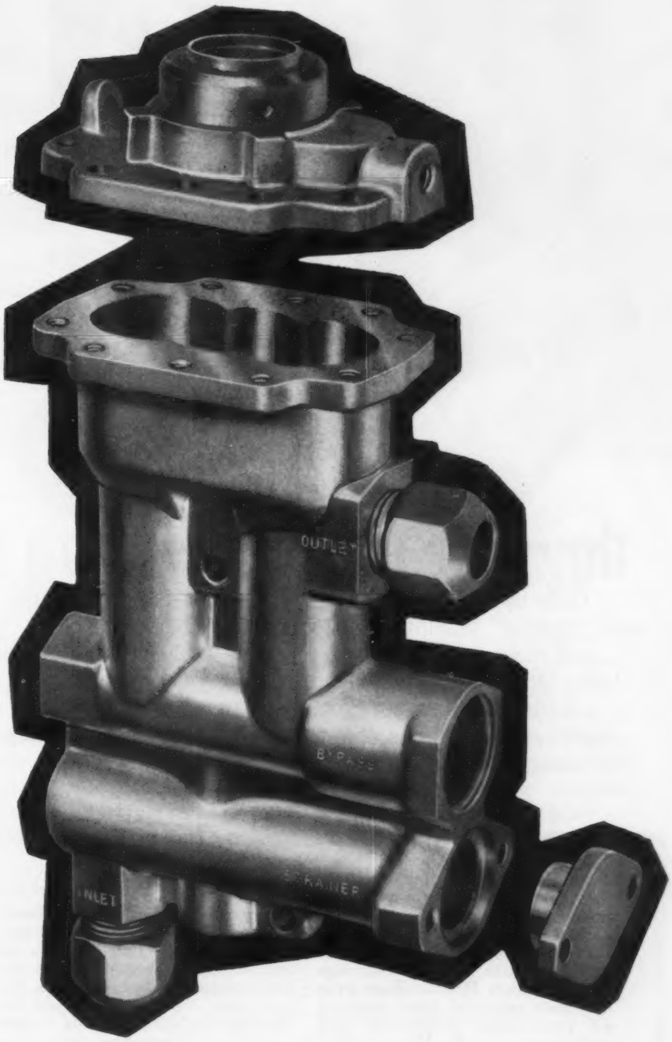
manufacture of

DETROIT SELECTAFLOW CONTROLS

greatly improved by

MUELLER BRASS CO. FORGINGS





One of the finest thermostat control mechanisms for year-around air-conditioning systems is the automatic SELECTAFLOW, a product of the Detroit Controls Corporation. To maintain the high quality of this efficient unit and at the same time speed up and simplify assembly, the body, bonnet and side cover are being forged and completely machined to close tolerances by the Mueller Brass Co. In all, thirty-four machining and finishing operations are performed. This is but one more example of how Mueller Brass Co. machined forgings have improved a product and speeded production. With a wide range of copper-base alloys for forgings, a tremendous background of product engineering, and facilities for precision finish machining, the Mueller Brass Co. can supply machined brass or bronze forgings to *your exact specifications.* It will pay you to consider Mueller Brass Co. forgings for your new or redesigned products. Write us for full color catalog and technical information.

MUELLER BRASS CO. STREAMLINE PRODUCTS

MUELLER BRASS CO.

PORT HURON 35, MICHIGAN

For more information on products advertised, use Inquiry Card, page 231

BEARINGS, Needle

Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Roller

Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Self Lubricating (Oilness)

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BEARINGS, Tapered Roller

Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust

Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BELT SHIFTERS

Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCHES, Work, and Bench Legs

Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.

Consolidated Mch. Tool Corp., 656 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

BENDING MACHINES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy, Chicago, Ill.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy, Chicago, Ill.

BLAST CLEANING EQUIPMENT

Modern Ind., Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.,
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

(Continued on page 282)

Plug in for air power nearest the job

Spot Schrader Couplers everywhere in your plant—along benches . . . on columns . . . wherever an air outlet means convenience. Schrader Quick-Acting Couplers make air as easy to "plug in" as electric current. Yes, bring air to the job, not the job to the air line—and you'll get greater portability in your air tools . . . eliminate extra lengths of hose and miles of foot steps.

Schrader Couplers are quick . . . they're safe . . . they're sure.

To connect, just push the adapter section into the check unit. Accidental uncoupling is impossible—it takes a positive manual twist of the check unit sleeve to disconnect the coupler and shut off the air.

Make compressed air accessible in your plant, as the largest and most modern plants have done. Schrader Couplers are available in many pipe thread sizes and hose adapters. And remember—Schrader produces a full line of cylinders, valves and other air control equipment, to make your compressed air circuits neat . . . efficient . . . reliable. For details, write today—or fill out the coupon below.

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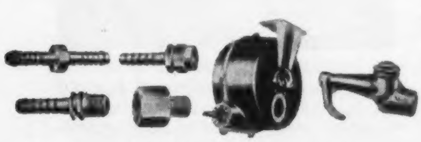
LEADERS IN AIR CONTROL SINCE 1844



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Company________________

Address________________

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For more information on products advertised, use Inquiry Card, page 231

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BLUING LAYOUT

Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLT AND NUTS

Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING AND TURNING MILLS, Vertical

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

(*Continued on page* 284)

It Packages 3 GREAT ADVANTAGES for you — *AND MORE*

CLEAR
COOL
CLEAN

You get more cuts and cleaner cuts. Triple C is non-gumming, non-galling, anti-rust. Friction is reduced. . . . Extreme pressure lubricity gives you longer tool life.

Triple C Cutting Coolant is water-soluble, non-oily and non-greasy. It is not subject to the development of any foul odor. Work pieces are not slippery; are easy to handle.

Your men will like Triple C Cutting Coolant, because it eliminates all fire hazards; is smokeless and foamless. Its vapor is harmless to the operator. There is no danger of skin infection. Work-pieces are clearly visible.

Triple C Cutting Coolant — the long awaited answer which sidelines serious obstacles to today's steadily increasing feeds and speeds. Tested and proven amazingly effective in nation-wide operation, Triple C actually revolutionizes technology in this field. Every molecule is a complete unit that contains all the elements requisite to ideal cooling and lubrication. Triple C solutions never break or separate. Lengthen your tool life! Step up production! Maintain accuracy and safety to your operators! *Triple C Cutting Coolant does all three!*

• *Your Motch & Merryweather dealer carries Triple C Cutting Coolant in stock.*

THE MOTCH & MERRYWEATHER MACHINERY CO.

CUTTING TOOL MANUFACTURING DIVISION
CLEVELAND 17, OHIO
Stocking Dealers in All Industrial Centers

TRIPLE-CHIP CIRCULAR SEGMENTAL AND SOLID CUT-OFF BLADES • TRIPLE-CHIP SLITTING SAWS • KROSLOK FACE MILLING CUTTERS AND END MILLS • TRIPLE C GRINDING COOLANT • TRIPLE C MACHINE CLEANER • TRIPLE C CUTTING COOLANT

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ingersoll Milling Mach. Co., 2442 Douglas St., Rockford, Ill.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

Cincinnati, Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R. Evanston, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Innocenti Corp., 43 W. 61st St., New York 23, N. Y.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Portage Machine Co., 1069 Sweitzer Ave., Akron 11, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bon St., Worcester 6, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

(Continued on page 286)

A SHORT CUT TO A FINISHED PRODUCT

SAVE YOURSELF TIME AND TOOL CHARGES

with Anaconda multiple-plunger press products—in a wide choice of metals

If you need parts like these in quantity, The American Brass Company can save you time and money. Through its specialized experience —and thousands of stock tools—it may save tool charges, too.

Ferrules, grommets, eyelets, deep-drawn cups and shells, and thousands of other intricate, close-tolerance parts made from strip metal are everyday business. American Brass Company design engineers and toolmakers have earned an enviable reputation for cutting costs and performing the almost impossible in design and production.

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American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING TOOLS

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
The Atrax Co. (Carbide), 240 Day St., Newington 11, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth-Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown Ohio.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss, E. W., Co., 1375 Raff Road, S. W. Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Detroit, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Detroit Broach Co., P. O. Box 156, Rochester, Mich.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.

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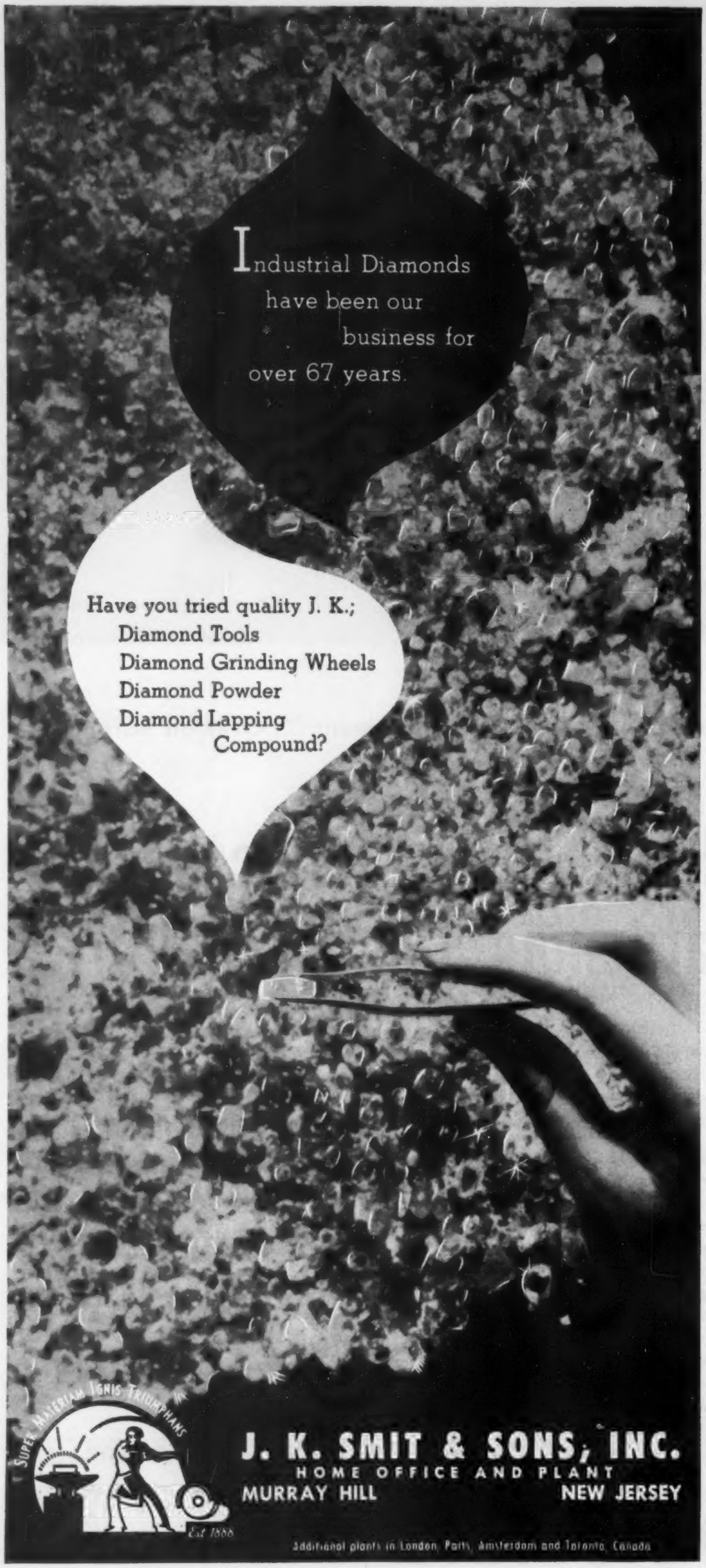

Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.

BUFFERS

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

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Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened

Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1925 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

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Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Sunstrand Machine Tool Co., 2351 11th St., Rockford, Ill.

(Continued on page 290)

ALLEN ⬡ SCREW . . . SOCKET SCREW

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Although *Allen ⬡ Screw* is not in the dictionary, engineers and production men the world over say *Allen ⬡ Screws* to refer to *precision socket screws.* That's how it is with names — probably there's a name that comes to your mind at once as an outstanding *Industrial Distributor* in your locality. He is almost certain to be the one who handles *Allen ⬡ Screw* products. His experience and extensive stock of Allen ⬡ products are the ideal combination to smooth out any problems you encounter in precision fastenings.

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Landis Tool Co., Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Machry. Co., 287 Homestead Aves., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jarvis Corp., Middletown, Conn.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernon Hwy., Detroit 1, Mich.

CASEHARDENING FURNACES

See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, DIE

American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.

CASTINGS, Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

(*Continued on page* 292)

CENTERS, Lathe

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co. (Single and Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(Continued on page 294)

For more information on products advertised, use Inquiry Card, page 231

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Jarvis Corp., Middletown, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS
General Electric Co., Schenectady 5, N. Y.

CLAMPS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal
Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

CLUTCHES
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

COLLARS, Safety
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS
See Gages, Comparator.

COMPARATORS, Optical
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

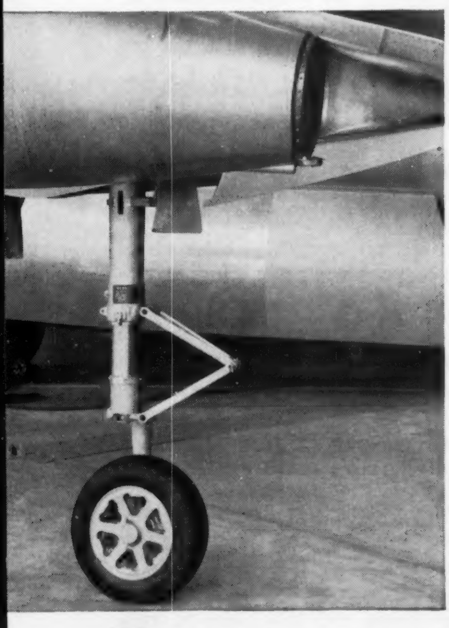
COMPOUNDS, Cleaning
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).

(*Continued on page* 296)

The Boeing B-47—Its six jet engines, each supplying 6,000 pounds thrust, put it in the "600-mile-per-hour speed class." Operating range is more than 3000 miles.

Cold drawn Shelby Seamless Tubes provide *high strength, low weight* outrigger struts for B-47 Stratojet



The landing gear of the 100-ton B-47 Stratojet consists of dual main wheels in tandem with single outriggers attached to the inboard engine pods. The outer cylinder of each of the outrigger struts is fabricated from cold drawn USS Shelby Mechanical Tubing.

Shelby Seamless is extremely strong and shock absorbent in proportion to its weight. Thus, it is ideal for incorporation into landing gears, engine mounts, longerons, wing spars, fuselage struts, and tail assemblies. Moreover, with Shelby Seamless Tubing, *the basic shape* for myriad aircraft parts is already made—and each section of tubing is as sound as the solid steel forging from which it is pierced. Thoroughly uniform and dimensionally accurate, Shelby Seamless Tubing is easy to bend, shape, machine and weld.

Shelby Seamless is produced to exacting aircraft standards, in a wide range of diameters, wall thicknesses and steel analyses. For further information or for help in applying Shelby Seamless Mechanical Tubing to your design specifications, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

"WALLS WITHOUT WELDS," the vivid story of the manufacture of National Seamless Pipe and Tubes is available free of charge for showing to industrial groups, clubs, school groups, etc. This educational sound film in brilliant technicolor contains some of the most dramatic steel mill operations ever recorded. Write for information.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)

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USS

SHELBY SEAMLESS MECHANICAL TUBING

WALLS WITHOUT WELDS

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Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

COMPOUNDS, Resin and Molding

General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

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Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

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Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Lees-Bradner Co., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett, Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

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Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONVEYORS FOR DUST, CHIPS, ETC.

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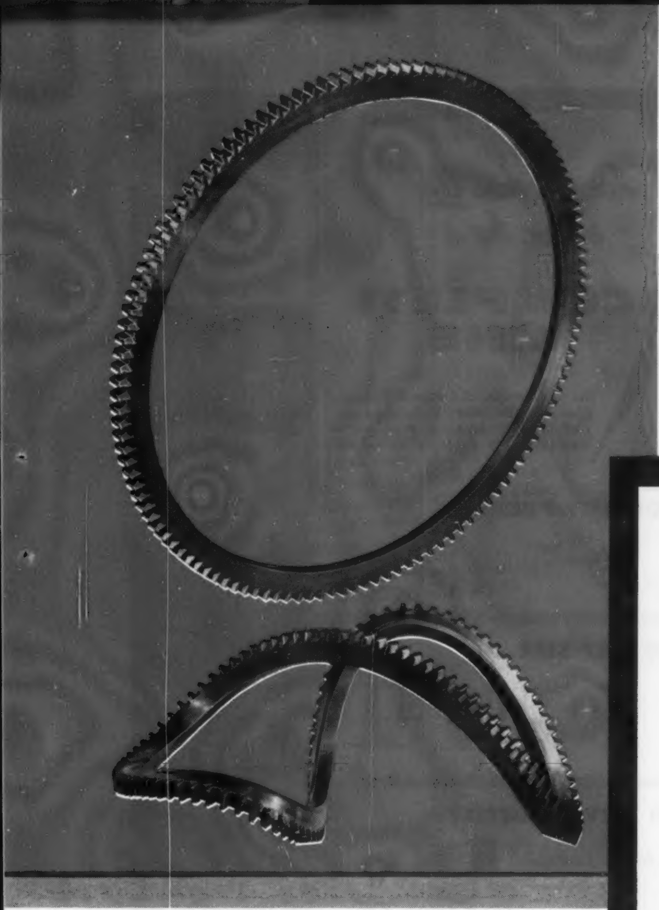
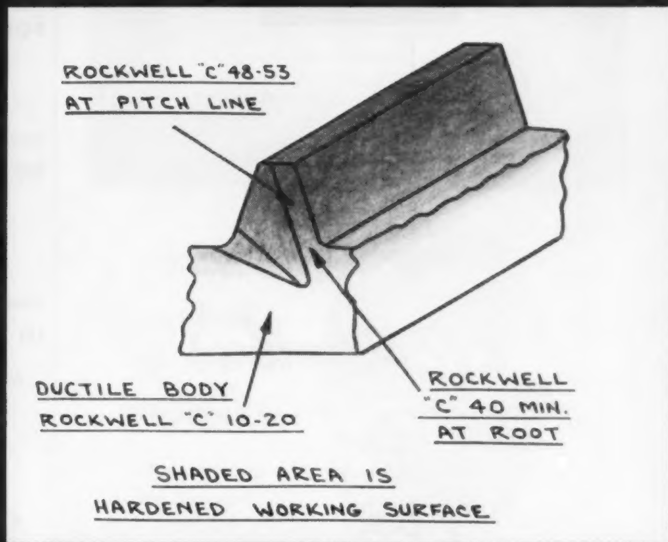
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.

(Continued on page 300)



THIN! TOUGH!

...and "tender-hearted"



THE MANUFACTURE of flywheel ring gears poses special problems. Sectional thickness is usually less than three-quarters of an inch. To withstand the impact force of the starter pinion, the gear teeth must be hard. But the gear body itself should be unhardened so that it will conform tightly to the flywheel, and "give" under the stress that might snap a brittle gear.

Note how DOUBLE DIAMONDS are made to be thin, tough, "tender-hearted." The above photo of a gear twisted into a pretzel shape graphically demonstrates ductility. The sketch at right shows three important areas: the wide and deep hardness pattern, the generous area of transition, and the ductile body. These extremes are achieved in DOUBLE DIAMOND Flywheel Ring Gears by controlled selective heat treatment—all essential to flywheel ring gears that provide the best possible performance.

Our Engineering Department will be glad to make constructive suggestions on the design of flywheel ring gears, or on the many other types in which we specialize. Write, phone or wire—depending on the urgency of your need.

DOUBLE DIAMOND TRADE MARK GEARS

GEAR-MAKERS TO LEADING MANUFACTURERS
FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS

Automotive Gear Works, inc.

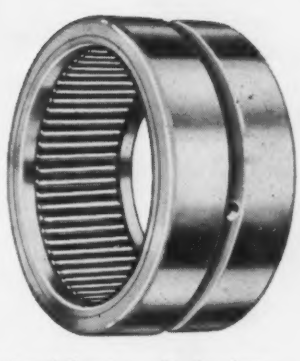
ESTABLISHED IN 1914 RICHMOND, INDIANA

Which of these ORANGE ROLLER BEARINGS is best for your application?

Look over this "family" of Orange Roller Bearings. Each type is designed to provide outstanding performance under specific conditions. When matched to your operating requirements, they can solve many design problems—cut costs—save space—speed up assembly—provide quiet, long-life, trouble-free operation.

- *Submit details or drawings for recommendation*
- *Field engineers available for consultation*
- *Engineering Data Books sent on request*

ORANGE ROLLER BUSHINGS

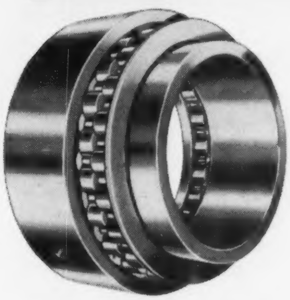


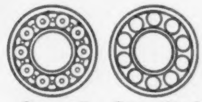
Maximum load capacity in small space

Install these space-saving full-type needle bearings to provide friction-free, long-life operation of rotating or oscillating parts. Electronically-gauged rollers permit closer internal running clearances, minimizing possibility of misaligned rollers. Quiet, even-running. Stock sizes ½" to 8" shaft diameters.

For heavy loads—severe service

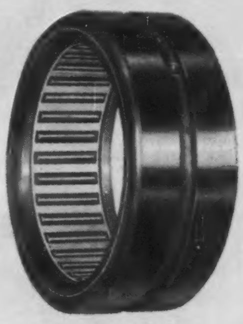
ORANGE "STAGGERED" ROLLER BEARINGS





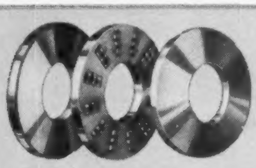
End views show how staggered roller arrangement distributes load over many short rollers, compared with conventional bearings. Often permits use of smaller bearings—always assures longer service life. Also prevents skewing tendencies of long rollers, provides more even running. All standard, fully interchangeable sizes.

ORANGE *Cage Type* NEEDLE BEARINGS



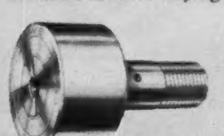
Prevent Roller Skewing

Anti-friction cage keeps rollers permanently aligned and true-running in any position—vertical, tilted, horizontal. Successful on overhung mountings and relatively high-speed installations. Less affected by misaligned mountings or uneven loading. Extremely smooth, quiet running. Sizes ½" to 8" shaft diameters.



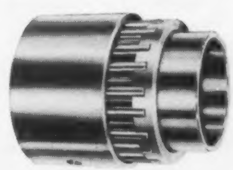
ORANGE THRUST ROLLER BEARINGS

Designed to provide maximum roller support for the load, with minimum wear. Available in designs and sizes to meet varying requirements.



ORANGE CAM FOLLOWERS

Compactly designed for high anti-friction protection under heavy load and intermittent shock. Available with standard or heavy studs, according to application.



ORANGE JOURNAL ROLLER BEARINGS

Provide high load capacity where radial space is limited, such as shafts close together or adjacent to shoulders. Available complete or component parts. Sizes ¾" to 5" shaft diameters.

ORANGE ROLLER BEARING CO., Inc.
552 Main St.
Orange, New Jersey

ORANGE

For more information on products advertised, use Inquiry Card, page 231

Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Jarvis Corp., Middletown, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

COUNTERS, Revolution

Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S., Co., Athol, Mass.

COUNTING DEVICES

Starrett, The L. S., Co., Athol, Mass.

COUPLINGS, Flexible

Boston Gear Works 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Sier-Bath & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

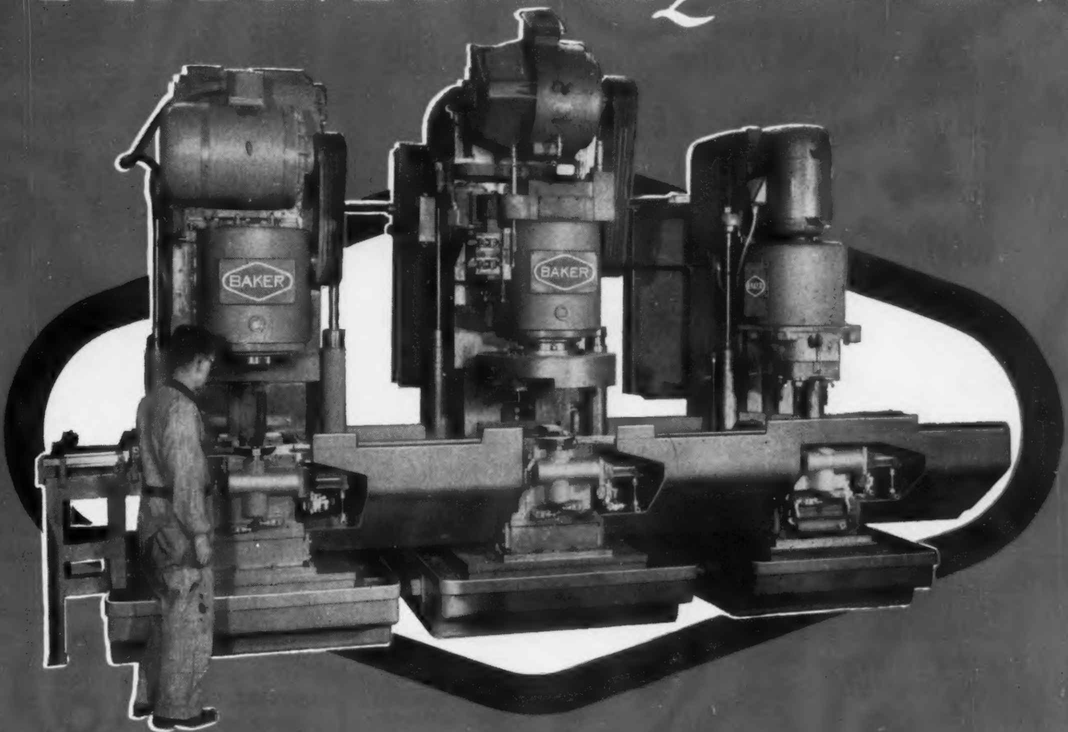
CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

(*Continued on page* 302)



BAKER
BAKER

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Works, Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tl Co., Rochester, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co. 1220 Woodward Heights Blvd,, Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burrs Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.

(Continued on page 304)

For more information on products advertised, use Inquiry Card, page 231

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Campbell Machine Div., American Chain & Cable, Bridgeport, Conn.
Hamilton Div., The Lodge & Shipley Co., Hamilton 1, Ohio.
Wallace Tube Co., 1304-08 Diversey Pkwy., Chicago, Ill.

CUTTING-OFF MACHINES, Cold Saw

See Sewing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo.

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2424 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

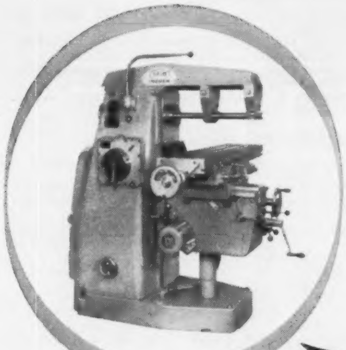
Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DEALERS, Machinery

Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

(Continued on page 306)

Swedish Craftsmanship!



headquarters

FOR THE FINEST SWEDISH MACHINE TOOLS

Austin is American headquarters for the fine machine tools that are manufactured in the modern Swedish machine tool center of Värnamo.

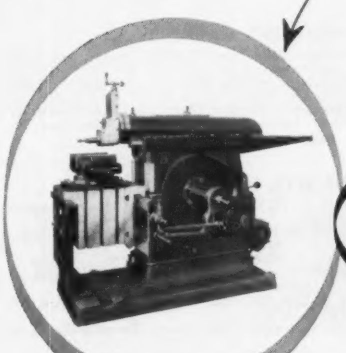
Built with the painstaking workmanship and quality materials that characterize Swedish products, these machine tools, since their introduction in the U.S.A., have earned an enviable reputation for accuracy and dependability in toolroom and production line. All machines comply fully with U. S. Standards.

SAJO #2 ALL GEARED MILLING MACHINES — plain and universal models — light and standard types, all built to modern design to meet industry's demand for fast, simplified operation while maintaining maximum accuracy. Available with longitudinal power feed only or with power feed and rapid traverse in all directions. Offered with full line of accessories.

SAJO HYDRAULIC HACKSAWS — Utility and Production Models — 6" x 6", 9" x 9" and 10" x 10" capacities. These sturdy machines, for intermittent or production duty, have unique patented features and are attractively priced. Sajo Hacksaws represent exceptional values in cutting off equipment.

PREMA 13" SHAPER — a "mighty mite" — ideal for applications where large shapers are not justified. "Big Shaper" performance and accuracy at modest cost makes the Prema a profitable addition in the toolroom or on light production work.

VMA SHAPERS are available in both standard and heavy duty models — 14" to 26" length of stroke. These rugged amply powered machines provide speedy set-up, ease of operation and maximum stamina in the toolroom or production line. Automatic lubrication and table power rapid traverse are standard on heavy duty models. Universal table and other accessories are available.



Service and spare parts available from us or from our dealers in principal cities.

For complete details, illustrated catalogs and information as to reference installation in your vicinity write to

austin INDUSTRIAL CORPORATION

76-E MAMARONECK AVENUE, P. O. BOX 430, WHITE PLAINS, N. Y.

Look for the Austin Seal — your full guarantee of satisfaction.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S. Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Specialty Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co. 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIAMONDS AND DIAMOND TOOLS

Christensen Diamond Prod., 1937 S. Second West, Salt Lake City, Utah.
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die

DIE-CASTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St. Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennamental Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mach. Co., Oakley, Cincinnati 9, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

DIE SETS, Standard

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 225 N. 18th St., Ampere, N. J.
Wales-Strippet Corp., North Tonawanda, N. Y.

(*Continued on page* 308)

DIE-SINKING MACHINES
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIE-SINKING PRESSES
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

DIE STOCKS
See Stocks, Die

DIES, Sheet Metal, Etc.
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mach Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

DIES, Threading
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg., Mansfield, Mass.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DIES, Thread Rolling
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DISCS, Abrasives
Besley-Welles Corp. (Abrasive Div.) 20 N. Wacker Drive, Chicago 6, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DISINTEGRATORS
Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS
See Indexing and Spacing Equipment

DOWEL PINS
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRESSERS, Grinding Wheel
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., Youngstown, Ohio.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

DRIFTS, DRILL
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Jarvis Corp., Middletown, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakewood Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

(Continued on page 312)

POTTER & JOHNSTON

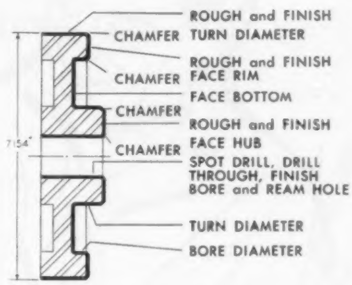
4-U AUTOMATIC TURRET LATHE

Handles TOUGH STEEL FORGINGS

Quickly . . . Economically

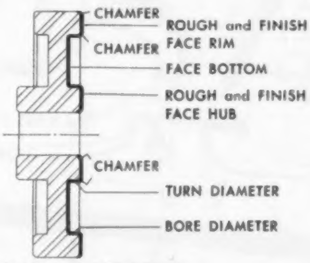
Jobs like machining this change gear blank, forged from 6150 steel, including boring the 1⅛" hole ***from the solid***, are easy, fast, profitable. That's because the P&J 4-U is a ***modern*** machine with the advanced design, added rigidity, and extra speed and power to take today's tough steels in stride.

WITH TOOLING ENGINEERED BY P & J EXPERTS



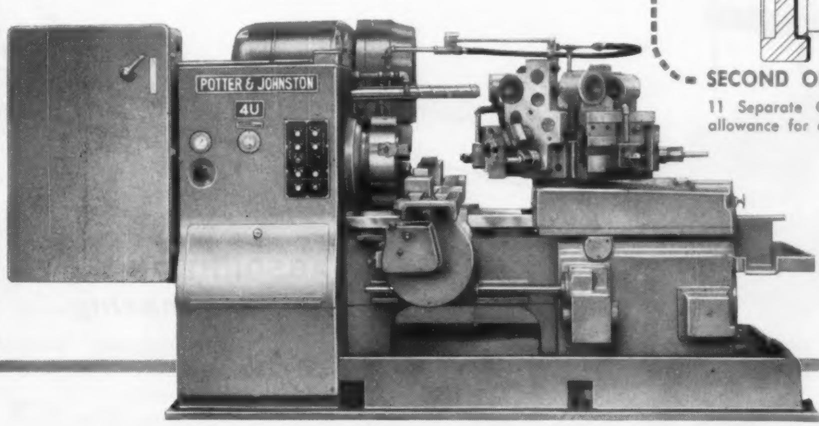
FIRST OPERATION

17 Separate Cuts, 3.41 minutes including allowance for chucking



SECOND OPERATION

11 Separate Cuts, 2.56 minutes including allowance for chucking



MODERNIZE *with* POTTER & JOHNSTON — REPLACE FOR PROFIT

TAKE ADVANTAGE OF DIRECT-FACTORY SERVICE

To serve you best, all P&J Automatics are made available to you through Potter & Johnston and Pratt & Whitney direct-factory Representatives. For full information on the 4-U and other P&J Automatics—plus expert application engineering—phone or write the P&W Branch Office conveniently near you.

POTTER & JOHNSTON COMPANY
PAWTUCKET, RHODE ISLAND
SUBSIDIARY OF
PRATT & WHITNEY COMPANY
INCORPORATED

BRANCH OFFICES • BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., PAWTUCKET R. I. • AGENT: HOUSTON, WESSENDORFF, NELMS & CO.

PRECISION PRODUCTION TOOLING — P&J — FOR MORE THAN FIFTY YEARS

For more information on products advertised, use Inquiry Card, page 231

How much did

ABSORPTION
is amazing . . .

"Perf-Embossed®" texture gives Scott Wipers their dirt-gripping, oil-drinking power

wiping cost you last month?

Switch to Scott Wipers—eliminate expensive handling, controls and lost production time . . . get more efficiency!

Add up your wiping costs for last month. What did you spend to count, sort, bale and launder wiping material? How much efficiency did you lose in distribution . . . in housekeeping . . . in production time?

New Scott Wipers—the strong, capable *disposable* wipers—put an end to all these inefficiencies, all these high cost "extras." But try the Scott Wiper yourself. Ask your local Scott salesman or distributor to help you set up a 90-day trial installation in your plant. Or mail this coupon today.

DISTRIBUTION
is simple . . .

The Dispenser-box is a portable supply of 125 wipers

And best of all, Scott Wipers are
DISPOSABLE!

SCOTT PAPER COMPANY
Dept. M-F, Chester, Pa.
Please send me full information on Scott Industrial Wipers.

Name____________________

Company____________________

Address____________________

City__________ State__________

For more information on products advertised, use Inquiry Card, page 231

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLING MACHINES, Automatic

Avey Drilling Mch., Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Stripper Corp., North Tonawanda, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 126 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

DRILLING MACHINES, Boiler

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Gang

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Horiz.

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Avey Drilling Mch Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch., Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

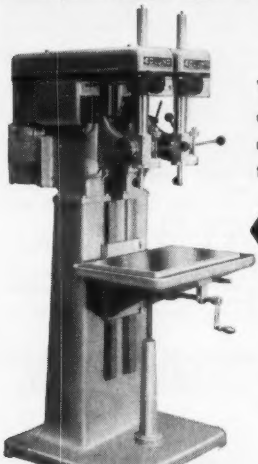
(Continued on page 314)

NOW! EDLUND "F" SERIES

Infinitely Variable Speed

EDLUND Drilling and Tapping Machines

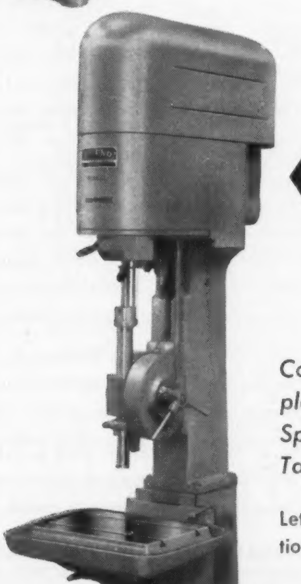
The Right Machine for You... For Your Job... For Your Product...



Whether you require light drilling operations of a sensitive nature, medium drilling and tapping, or heavy duty operations in all types of materials, there is an Edlund 'F' Model for you.

Edlund Model 1F
Drilling and Tapping Machine
Extreme sensitivity
Infinitely Variable Speeds to 10,000 RPM
Micrometer Graduated Depth Gauge to .001″
Adjustable Spindle Tension Control
7″ Overhang, 3/8″ Capacity

Edlund Model 2F
Drilling and Tapping Machine
For Medium to Heavy Drilling & Tapping Operations
Infinitely Variable Speeds to 3600 RPM
8″ or 12″ or 15″ Overhang, 1¼″ Capacity



Edlund Model 4F
Drilling and Tapping Machine
For Heavy Duty Drilling and Tapping Operations
Infinitely Variable Speeds to 2200 RPM
12″ Overhang, 1½″ Capacity

Cost-cutting features, make Edlund "F" Models the logical choice for plant expansion and for replacing obsolete equipment. Standard or Special Models from 1 to 8 spindles, with Power Feed, Reversing Motor Tapper, Lead Screw Tapper, and Back Gears are Available.

Let us supply you with case history folders, descriptive bulletins, complete specifications and quotations. Write us today at no obligation.

Edlund Representatives in Major Cities

EDLUND
MACHINERY COMPANY
Cortland, New York
Division — Precision Castings Co., Inc.

For more information on products advertised, use Inquiry Card, page 231

Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cleveland Tapping Machine Co., 1201 Camden Ave., S. W., Canton 6, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14320 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Upright

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bausch Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS Center

The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Wells Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.

(Continued on page 316)

QUIET

"Magnamatic" controlled torque screwdriver at work!

CP One-Shot "Magnamatic" is the quietest screwdriver-nutrunner ever developed! Clutch buzz and ratcheting have been eliminated and exhaust noise is effectively muffled by a new principle of baffling.

Quiet One-Shot "Magnamatic" is an air-driven screwdriver-nutrunner that can be set to run nuts and screws to specified torque. Here's how: The Alnico magnetic One-Shot clutch, adjustable to specified torque, disengages completely the instant the fastener is driven to desired tightness. Maintains the selected torque setting indefinitely—prolongs clutch jaw life. Inexperienced operators don't burr screw heads, strip threads, shear fasteners, or damage work. Screw bits last longer.

Only Quiet One-Shot "Magnamatic" has Torque Control PLUS all these advantages:

- Doesn't require frequent readjustment to hold torque value.
- Completely disengages the instant the fastener is run to desired tightness.
- Eliminates stripped threads, sheared fasteners, surface damages.

CAPACITIES: **#4 screws to 3/8" bolts. Reversible and non-reversible types.**

Chicago Pneumatic Tool Company, Dept. M-10
8 East 44th Street, New York 17, N. Y.

- ☐ Please send me FREE booklet SP-3165 "Magnamatic Case Histories."
- ☐ Please send me "Magnamatic" Bulletin SP-3126.
- ☐ Have representative call.

Name________ Title________
Company________
Address________
City______ Zone______ State______

CP

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

For more information on products advertised, use Inquiry Card, page 231

Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Ace Drill Corp., Adrian, Michigan.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Ace Drill Corp., Adrian, Michigan.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati Ohio.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland

Ace Drill Corp., Adrian, Michigan.
Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Ace Drill Corp., Adrian, Michigan.
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.

(Continued on page 318)

NEW design freedom

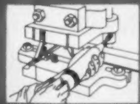
FEATURED IN THE EXPANDED DANLY DIE SET LINE

NOW Danly meets or beats all ASA standards . . .

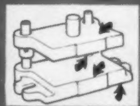
with the world's broadest die set line. There's no need for compromise between the standard set you want and the set you can get, less need for costly specials. The new line of Danly Standard Die Sets has die space and guide post dimensions that equal, *or exceed*, ASA specifications. Under the new standards, front to back die space is measured *from edge of bushing to front of die set.*

In addition to offering a complete selection of ASA standard die sets, Danly provides the Danly Standards proved popular over the years . . . all available from stock at your nearest Danly Branch. You can be sure of meeting all your die set needs at Danly . . . either ASA standard or Danly Standard.

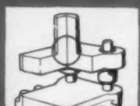
NOW Danly offers you these additional features



Oil Lubrication System For Shoulder Bushing Sets. This new Danly die set feature assures longer life, easier maintenance, proper lubrication even during long runs.



All Horizontal Surfaces Ground On New Danly Die Sets. Horizontal surfaces, including top of punch holder and bottom of die holder, are ground to the same exacting precision as the inner die set surfaces.



Integral Welded Shanks. 100% weld on all-steel sets regularly furnished with shanks gives greater strength and rigidity. Deep counterbores in punch holder have less tendency to weaken set.

DANLY®

DIE SETS AND DIEMAKERS' SUPPLIES

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue, Chicago 50, Illinois.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Ace Drill Corp., Adrian, Michigan.
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATORS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DUST COLLECTORS

Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT

General Electric Co., Schenectady 5, N. Y.

EMERY WHEEL DRESSERS

See Dressers, Grinding Wheel

EMERY WHEELS

See Grinding Wheels

END MILLS

The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Screw

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Hack

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary

The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jarvis Corp., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engineering Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

(*Continued on page* 320)

Smooth, even finishes are easier with Heller Spiral-Cut Half Round Files. Ordinary half round files require a skillful twisting. Heller engineering has removed this human element from good file performance. The necessary rolling action is designed right into the Heller Spiral-Cut Half Round File. This new cutting principal is typical of Heller's continuous search for better files. By constantly testing, inspecting, improving . . . Heller guarantees file users "the best."

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FLEXIBLE SHAFT EQUIPMENT

Jarvis Corp., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.

FORGINGS, Machines (Upsetting)

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.

FORGINGS, Drop

Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored

Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel

Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset

Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Gerrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Mahon, R. C. Co., Detroit 34, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

FURNACES, Heat-Treating

General Electric Co., Schenectady 5, N. Y.

FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co. Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air

Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

(*Continued on page* 322)

GAGES, Comparator

Ames, B. C., Co., Waltham 54, Mass.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1 Ohio.

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Elgin National Watch Co., Aurora, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 17, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

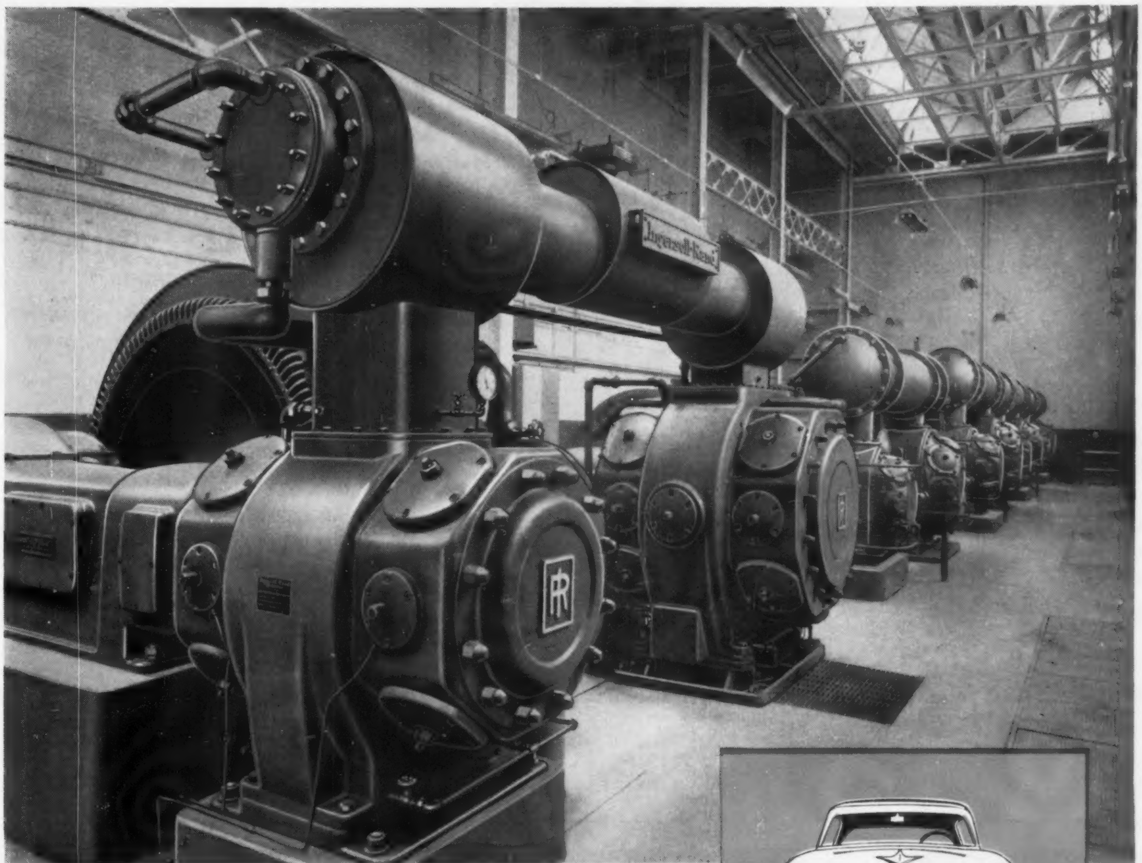
GEAR BLANKS, Non-Metallic

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
General Electric Co., Schenectady 5, N. Y.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

(Continued on page 324)



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COMPRESSORS • CONDENSERS • AIR & ELECTRIC TOOLS • PUMPS • ROCK DRILLS • GAS & DIESEL ENGINES

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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Scherr, George Co., Inc. 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield Vt. (Straight and Hourglass Types).
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave. Detroit 2 Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Wks, 1309 So. Cicero Ave., Chicago 50, Ill.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

(*Continued on page 326*)

For more information on products advertised, use Inquiry Card, page 231

New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.

Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric
General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

GRADUATING MACHINES
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.

GREASE
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool
See Grinding Mches., Carbide Tool

GRINDERS, Die and Mold
Consolidated Mch. Tool Corp., Rochester, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDERS, Oilstone, for Woodworking Tools
Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

GRINDERS, Portable Electric and Toolpost
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING FIXTURES
Geometric Tool Co., (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench
Atlas Press Co., Kalamazoo, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

GRINDING MACHINES, Broach
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernon Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Chucking

Baird Machines Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Drill

Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobbs, Etc.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1 Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2448-90 River Rd., Cincinnati, Ohio.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Piston Ring

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

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Consolidated Mch. Tool Corp., Rochester, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

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Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

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Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread
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Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GRINDING MACHINES, Universal
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Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.

GRINDING MACHINES, Worm
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

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Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

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Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

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Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

HAMMERS, Forging Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

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Ingersoll-Rand Co., Phillipsburg, N. J.

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HAMMERS, Power
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Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

HAMMERS, Shaft
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft
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Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

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Gleason Works, 1000 University Ave., Rochester, N. Y.

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HOBS
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(Continued on page 330)

HOISTING AND CONVEYING EQUIPMENT
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

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HOISTS, Electric
Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
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Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

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Carborundum Co., Buffalo Ave, Niagara Falls, N. Y.
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Norton Co., 1 New Bond St., Worcester 6, Mass.

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Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
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Denison Engrg Co., 1160 Dublin St., Columbus 16, Ohio.
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Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
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Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

(Continued on page 332)

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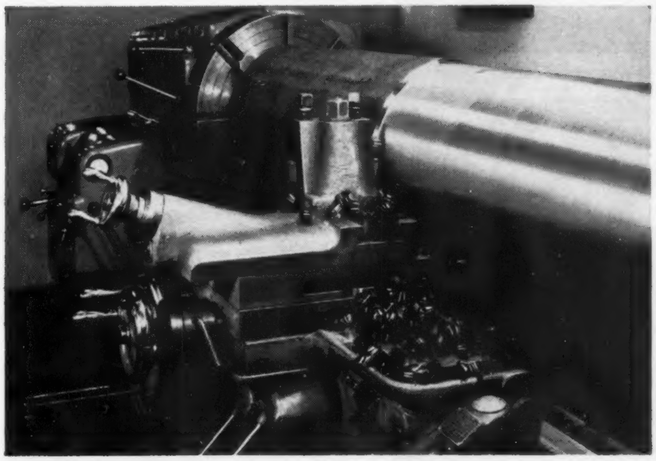

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Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

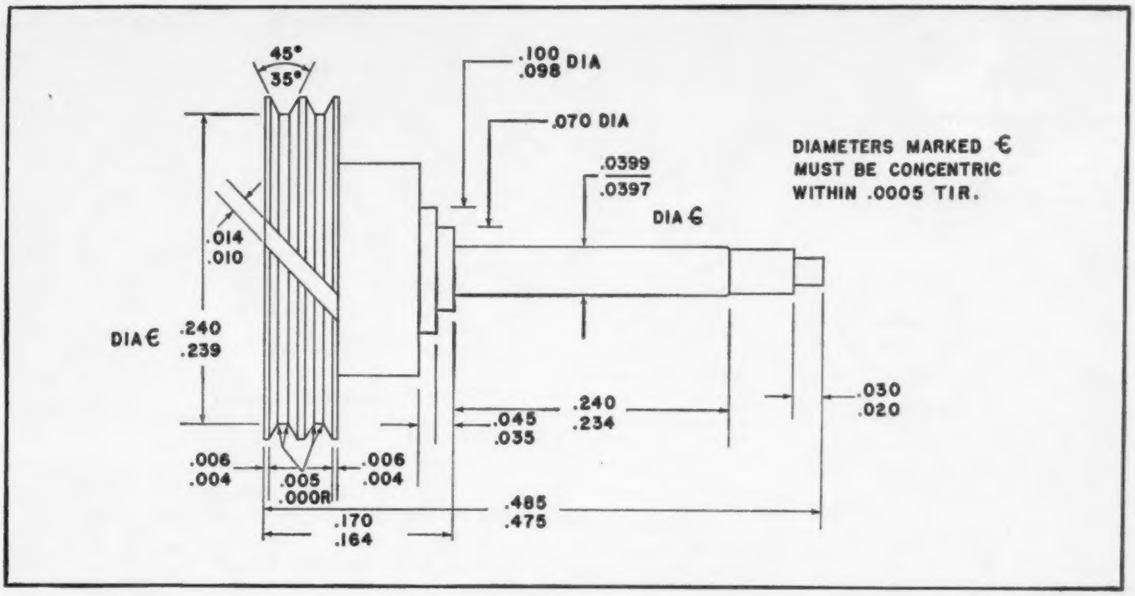
LAPPING MACHINES

Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 Unviersity Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

(Continued on page 334)



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Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2431 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Automatic
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench
Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Levin, Louis & Son, Los Angeles 21, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Hydro-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio.

LATHES, Hollow Spindle
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning
Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom
See Lathes, Engine and Toolroom

LATHES, Turret
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret
American Steel Foundies, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co. 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.

LAYOUT FLUID
Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS
Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wyler Max, 611 W. 43rd St., New York 36, N. Y.

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Arter Grinding Machine Co., 15 Sagamore Rd., Worcester 5, Mass.

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Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.

(Continued on page 336)

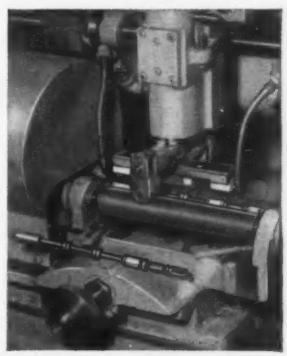
SUPERSONIC... *the Douglas F4D "Skyray" breaks the sound barrier at speeds of over 750 m.p.h.*

...and GISHOLT SUPERFINISH
breaks another cost barrier!

Do you think of SUPERFINISH as an expensive process? Then it's high time you know the facts.

Here's an excellent case in point... on the record-breaking Douglas "Skyray." Among the most precise parts on this supersonic jet are the slide valves. They're ground from the solid, first on a cylindrical grinder, then on a centerless grinder. Then they're transferred to a Gisholt Superfinisher where the bearing surfaces get a finish of 3 micro-inches, r.m.s Former time for hand-lapping ran from $2\frac{1}{2}$ to 3 hours per piece. The Gisholt SUPERFINISHER does it in 45 seconds! Think of it: less than 1/200th of the time! And think what that does to costs!

If SUPERFINISH can improve your product, as probably it can, better get the facts. Write today for complete information—ask for booklet, "Superfinishers," Form 1169.



Approximate diam. of slide valves (lower left) is ½" with reduced diam. of ¼" between collars, or bearing surfaces. Parts are handled on the Gisholt Superfinisher in only 45 seconds per piece.

THE GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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Socony Mobile Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

LUBRICATING SYSTEMS
Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

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MAGNETIC BASES FOR INDICATORS
du Mont Corp, Greenfield, Mass.

MANDRELS
See Arbors and Mandrels

MARKING MACHINES AND DEVICES
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MEASURING MACHINES AND INSTRUMENTS, Precision
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Max Wyler, 611 W. 43rd St., New York 36, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

METAL, Bearings
See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METAL FINISHINGS
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

METERS
See Recording Instruments

MICROMETERS
Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmakers
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

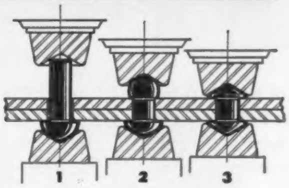
MILLING AND CENTERING MACHINES
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench
Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

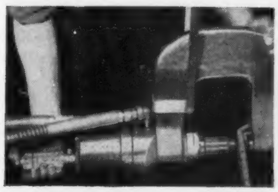
(Continued on page 338)

STRONGER JOINTS!



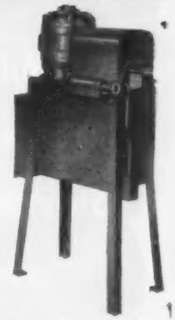
This "silent squeeze" method gives you (1) rapid advance to riveting position, (2) high-pressure shaping of the rivet, cold or hot, and (3) automatic reversal as soon as the rivet is formed. Why are these rivets stronger? Because with this method the rivet shank expands to completely fill the hole and, as the metal flows to shape the heads, fillets are formed under both heads. The rivet is work-hardened, too, and every rivet is uniform.

FASTER RIVETING!

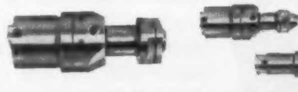


Yes! From the time the button is touched it takes only 2½ seconds to head a ⅜" rivet. *"Hy-Power" is safe, too!* For the stroke can be interrupted and the ram reversed automatically anywhere in the cycle, simply by releasing the control button.

QUIETER OPERATION!



Here's the power source for this modern riveting method . . . it's the Hannifin "Hy-Power" Generator. This compact unit is a combination of motor, pump, oil reservoir, automatic control valves and high pressure intensifier that quietly supplies hydraulic pressure to...



...your "Hy-Power" cylinders—available in 7½, 10, 12½, 17½, 25, 35, 50, 75 and 100-ton capacities (more in multiple). Cylinders can either be mounted in yokes (portable or stationary) or installed in machines of your design.

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Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

For more information on products advertised, use Inquiry Card, page 231

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Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain And Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Ingersoll Milling Mch Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sunstrand Mch.. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co. 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 29, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

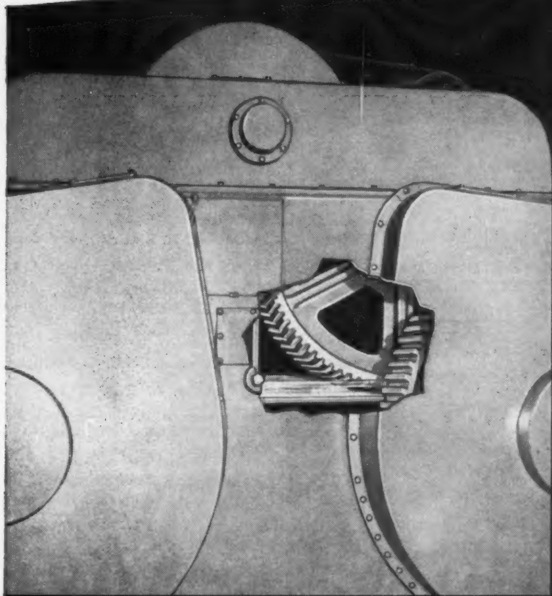
MILLING MACHINES, Turret Type

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bridgeport Machine, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27, Ohio.

(*Continued on page* 340)



These are the features **that make -Verson- presses your best buy**

DRIVE GEARS

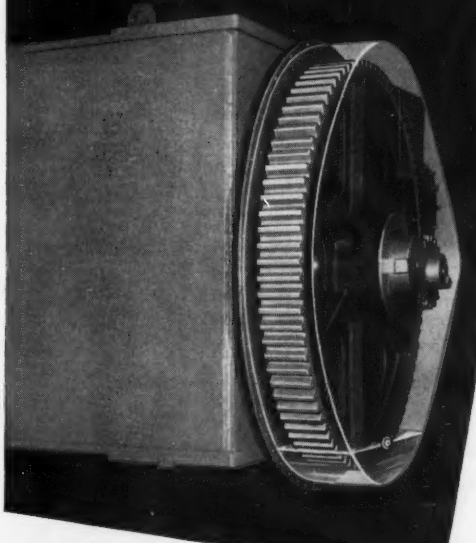
operate in oil bath to assure long life and smooth, efficient operation with

Verson

PRESSES

Cutaway showing how herringbone intermediate gears operate in oil bath within the crown.

Cutaway showing Verson main gears and the oil bath in which they operate.

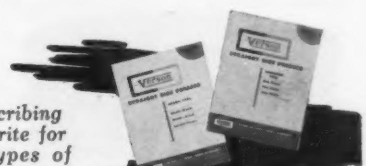


As the cutaway views at the left show, drive gears in Verson presses are fully enclosed and operate in an oil bath.

This is the positive way of insuring effective lubrication. Each tooth of the gear passes through the oil on each revolution to pick up its protective film of oil. For the press user, it is the kind of protection that means smooth, efficient operation throughout a long, trouble-free life.

Gears operating in oil is just one of the many advantages built into Verson Presses to give the user more and better stampings at lower overall cost. Whether you require a single press or an entire stamping plant complete with tooling, be sure to get the whole story of what Verson quality can mean to you.

For specific recommendations, send an outline of your requirements.



Catalogs are available describing the Verson lines. Please write for yours, mentioning the types of presses in which you are interested.

A Verson Press for every job from 60 tons up.

TRADE Verson MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

For more information on products advertised, use Inquiry Card, page 231

MODEL AND EXPERIMENTAL WORK
See Special Machinery and Tools

MOLD AND DIE COPYING MACHINES
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

MOLDING MACHINES, Plastic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rickford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

MOTORS, Electric
Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES
International Nickel Co., Inc., 67 Wall St., New York, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

NIPPLE THREADING MACHINERY
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

NUT TAPPERS
See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap
Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

NUTS, Thumb or Wing and Cap
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

OIL EXTRACTORS AND CLEANERS
De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

OIL SEALS
Chicago Rowhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

OILS, Soluble
See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Special
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

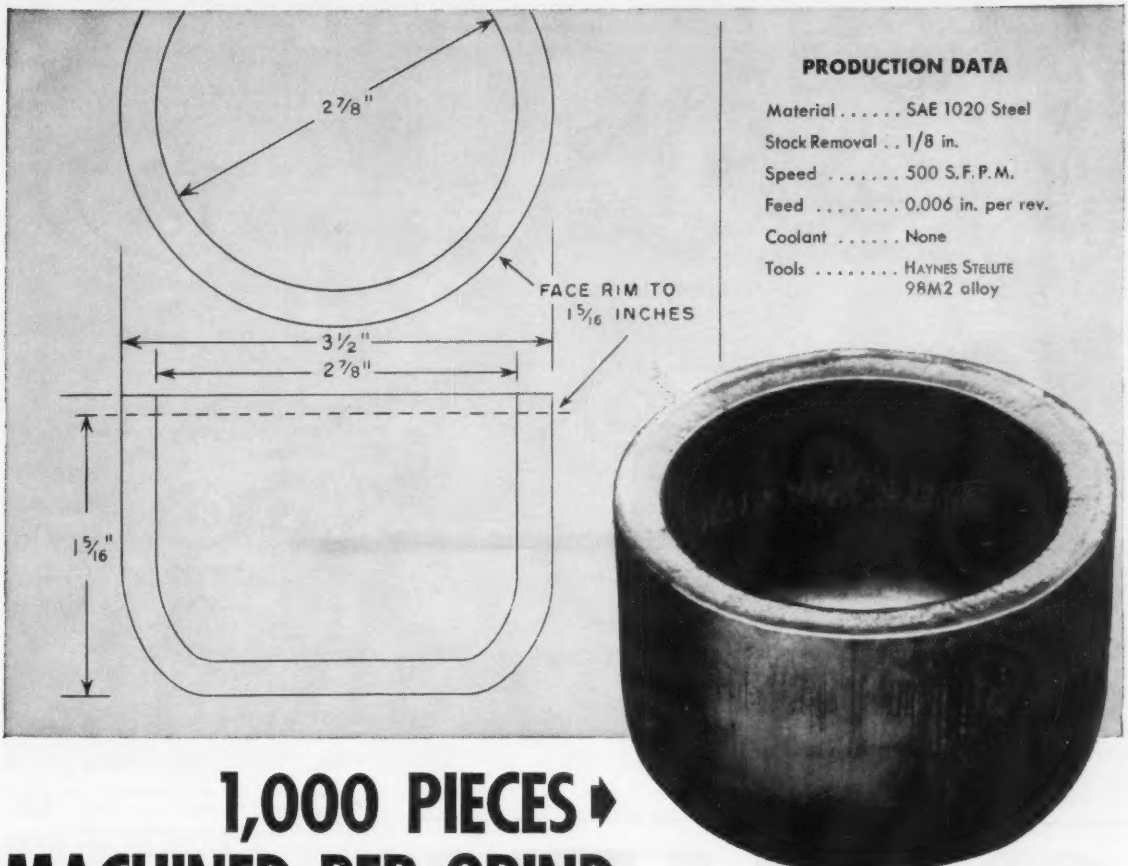
PAINTING EQUIPMENT, Spray
Lowe Bros. Co., Dayton, Ohio.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

(Continued on page 342)



1,000 PIECES ➧ MACHINED PER GRIND ...despite rough, uneven cut

HAYNES STELLITE 98M2 tools machine over a thousand of these torque converter cups between grinds. The cups are deep drawn from SAE 1020 steel, and are plunge cut. The area to be machined is rough and uneven. The HAYNES STELLITE tools operate for a full eight-hour shift, at a speed of 500 surface feet per minute, without chipping or spalling. No coolant is used.

HAYNES STELLITE tools are successful on applications like this one because they have good impact strength, high compressive strength, and their cutting edges remain hard and sharp even when red hot. This same combination of properties makes them valuable on all machining jobs. They remove metal fast. They can be used at high speeds with comparatively high feed rates, and they can take deep cuts.

For information on how HAYNES STELLITE tools can help speed up your machining jobs, write for the booklet, "HAYNES STELLITE Metal-Cutting Tools." It gives helpful information on chip formation, tool design, and the machinability of metals.

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago • Cleveland • Detroit • Houston • Los Angeles • New York • San Francisco • Tulsa

For more information on products advertised, use Inquiry Card, page 231

PIPE, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt, & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS

Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLANERS

Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Angle

Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.

PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
Challenge Machinery Co., Grand Haven, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Onsrud Machine Works Inc., 394[illegible] Palmer St., Chicago, Ill.

POLISHING LATHES AND MACHINES

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., [illegible]90 River Rd., Cincinnati, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

PRESSES, Arbor

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Threadwell Tap & Die Co., Greenfield, Mass.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Hydropress, Inc., 350 Fifth Ave., New York, N. Y.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PRESSES, Foot

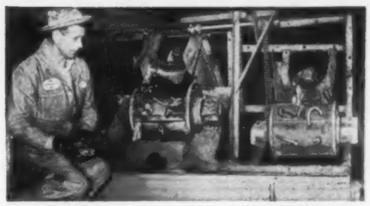
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnatti, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
National Mchy. Co., Greenfield and Stanton Sts., Tiffin, Ohio.

(*Continued on page 344*)

9½ Pound Magnetic Octopus, about 12" square, primarily designed for dip tank use in hot or corrosive liquids, as shown. Utilizing Alnico magnets in 3 small stainless steel (18-8) tubes, it retrieves tools, tramp iron and tiny iron particles from hard-to-reach bottoms of ovens, troughs, tanks and other vessels.



Better Product Assured where Eriez permanent magnetic drums remove stray iron from tallow and meat scraps.

"Octopus" shows use of magnetic nickel alloy for diverse application

THIS MAN HOLDS a deceptively simple Eriez tool, well-named a magnetic "Octopus."

It is completely non-electric. Yet its powerful, permanent magnetic strength is capable of lifting and holding sizable amounts of ferrous metal objects or masses.

This potent, permanently dependable magnetic power stems from ALNICO . . . an aluminum-nickel-cobalt-iron alloy.

The remarkable permanent magnetic strength of this nickel alloy provides two basic advantages:

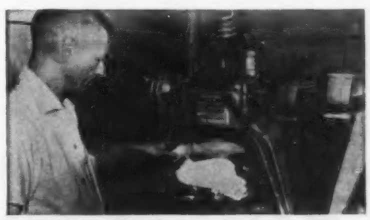
(1) No need for electromagnets, current and accessory equipment.

(2) Reduction of tool size and weight to desirable limits.

These are utilized in tools made by Eriez Manufacturing Company, Erie, Pa. for hundreds of diverse applications.

The addition of nickel... essential in Alnico permanent magnets . . . helps scores of other alloys meet particular fabrication and service demands. So if you encounter difficulty with metal for a specific application, let us give you some practical help. Write for . . . List A of available publications. A simple form makes it easy for you to outline your problem.

Safeguards Hammer Mill. Eriez non-electric magnetic pulley removes tramp iron from wood chips on belt feeding the mill and explosive mixtures beyond.



Cleans Powdered Chemicals. Eriez permanent magnetic grate removes invisible iron particles from drugs and the like.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N. Y.

For more information on products advertised, use Inquiry Card, page 231

Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros., Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. &Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Detroit Broach Co., (special & Semi-special) P. O. Box 156, Rochester, Mich.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.
Young Mch Tool Div., Church Rd., Bridgeport, Pa.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Corp., 604 Seventh St., Grand Haven Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch Co. (Hydroform), Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Mch. Corp., Div. U. S. **Industries, Inc.,** 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Aves., Philidalphia, Pa.
Famco Machine Co., 3134 Sheridon Rd., Kenosha, Wis.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PROFILE—TRACING ATTACHMENTS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa. (Lathe).

PROFILING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George Machine Co., 1110 W. 13th St., Racine, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

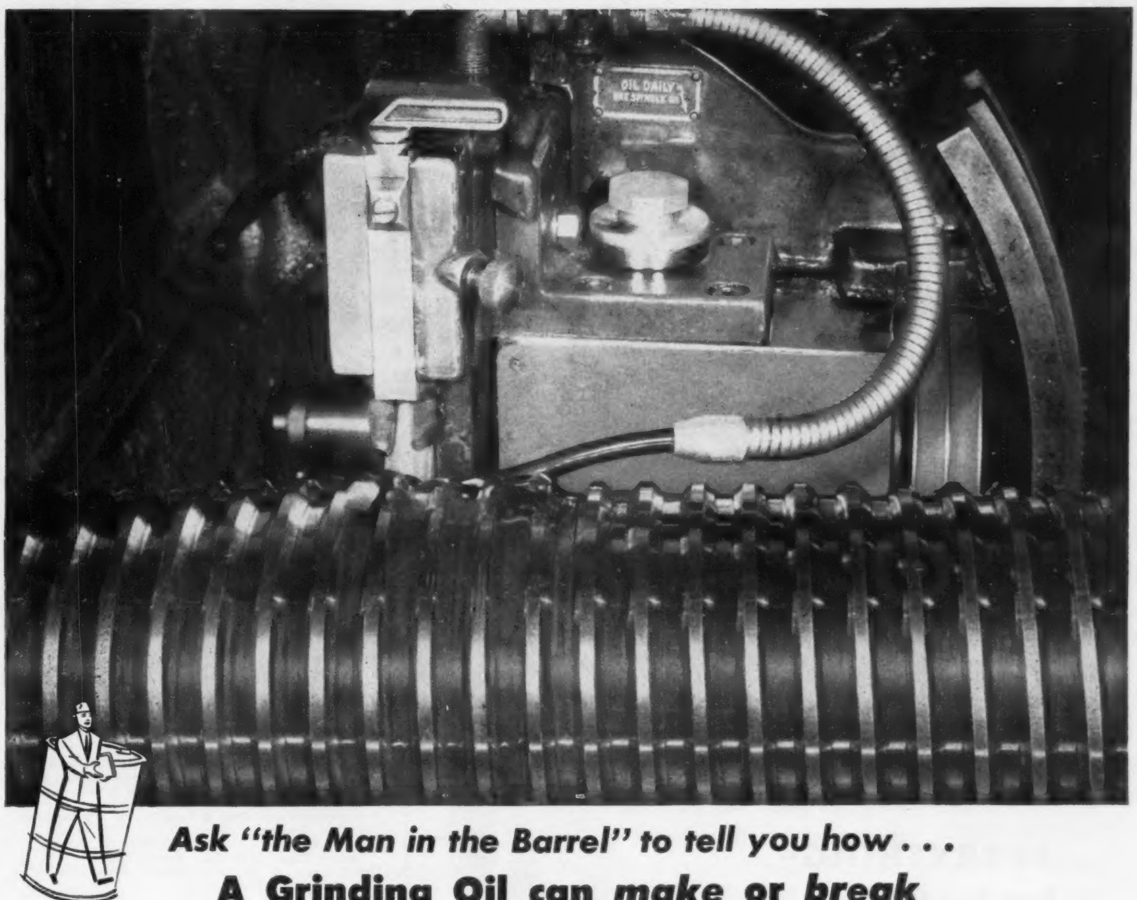
PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

(Continued on page 346)



Ask "the Man in the Barrel" to tell you how . . .

A Grinding Oil can <u>make</u> or <u>break</u> precision grinding jobs!

If you're using *just a coolant* or any oil that happens to be handy for those precision grinding jobs . . . it's costing you money!

A grinding oil can make or break a precision grinding job such as thread grinding, gear grinding and many types of form grinding. Grinding oils are usually classified as "hard-acting" or "soft-acting" depending on how they affect grinding wheel hardness. Grinding oil characteristics must be closely co-ordinated with wheel characteristics, speeds, feeds, and material machinability and hardness to obtain maximum performance.

When form grinding low hardness materials, where wheel form is important, a "hard-acting" oil helps to maintain proper wheel form by making the wheel act harder. As a result, greater wheel life is obtained and more accurate parts are produced.

When a high hardness material is being ground there is a tendency for the wheel to load-up and glaze. Such a condition is the cause of burnt work surfaces and heat checks, and is often encountered when grinding taps, gauges and other hardened parts. A "soft-acting" grinding oil will make the wheel act softer, opening up the wheel and exposing new abrasive grains to do the work.

Stuart's complete line of grinding oils have been chemically balanced and scientifically tested to meet the demands of various types of precision grinding operations. "The Man in the Barrel," your trained Stuart Representative, will be happy to assist you in selecting the proper grinding oil for your particular needs. Ask to have him call . . . and ask for a Stuart's Precision Grinding Oil Bulletin, too.

D. A. STUART OIL COMPANY, LTD.
2739 S. Troy Street, Chicago 23, Ill.

More than a "Coolant" is Needed

Stuart Oils

Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, Philadelphia and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.

For more information on products advertised, use Inquiry Card, page 231

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary

Brown & Sharp Mfg. Co., Providence, R. I.
Sier-Bath Gear & Pump Co., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Allen, Alva F., Box 426, Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Engineering & Research Corp., Riverdale, Md.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharp Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Ace Drill Corp., Adrian, Michigan.
The Atrax Co. (Carbide), 240 Day St., Newington 11, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Jarvis Corp., Middletown, Conn.
Lipe-Rollaway Corp., 806 Emerson Ave., Syracuse, N. Y.
Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1 Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1 Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co. Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling, Inc., 3113 Forbes St. Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Pratt & Whitney West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd. Plymouth, Mich.

REAMERS, Taper Pin

The Atrax Co. (Carbide), 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS

National Acme Co. (for counting), 170 E. 131st St., Cleveland, Ohio.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

REELS, Stock, Standard and Automatic

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace

Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature

General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.

Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

(Continued on page 348)

For more information on products advertised, use Inquiry Card, page 231

RHEOSTATS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET SETS
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

RIVETERS, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Wood & Co., R. D. Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

RIVET MAKING MACHINES
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

RUBBER PRODUCTS
Garlock Packing Co., Palmyra, N. Y.

RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment

SANDERS
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

SAW BLADES, Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.

SAW SHARPENING MACHINES
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular
Consolidated Mch Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
Wallace Tube Co., (Abrasive) 1304-08 Diversy Pkwy., Chicago 14, Ill.

SAWING MACHINES, Friction
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWING MACHINES, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWS, Circular Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SAWS, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SAWS, Portable Electric
Millers Falls Co., Greenfield, Mass.

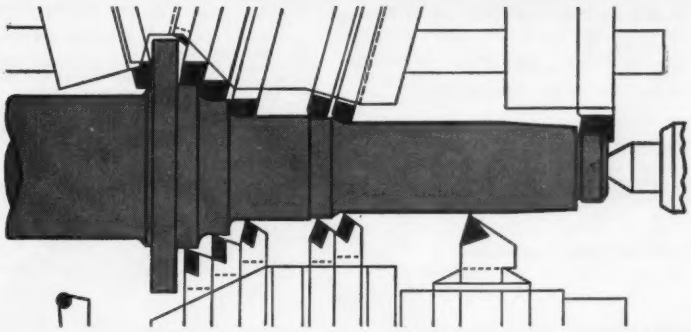
SAWS, Screw Slotting
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

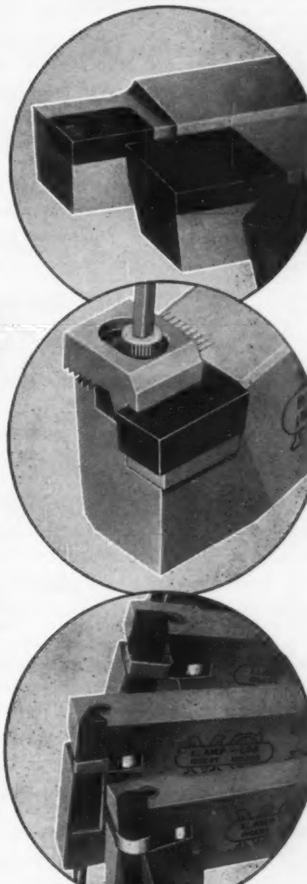
SCREW DRIVERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

SCREW DRIVING AND NUT SETTING EQUIPMENT
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
(Continued on page 350)

THE TURNING POINT TO HIGHER PROFITS!



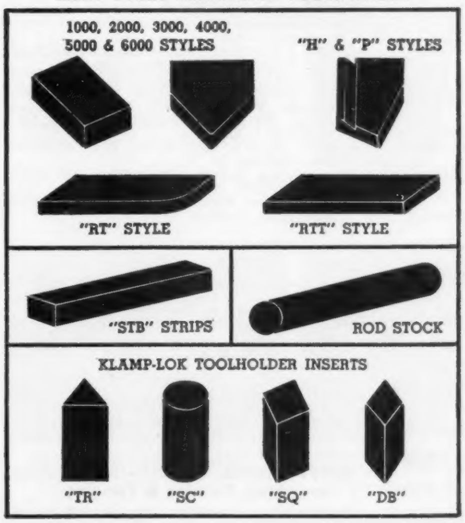
ALL-PURPOSE TALIDE TOOLS



PRODUCTION RATE—UP 25%, TOOL COST—DOWN 40% AT LARGE MID-WEST TRACTOR PLANT

PART.............Shaft Steering Clutch, SAE 8654-H Brinell 370.
OPERATION.....Rough Straddle Face Flange, turn all diameters, form undercut and base.
MACHINE.......16 x 60 Sunstrand Automatic Lathe.
TOOLS...........8 Talide-tipped facing, chamfering, radius and form tools Grade S-88. 7 Klamp-Lok Toolholders with round, triangular and parallelogram Talide inserts Grade S-88.
DEPTH OF CUT..9/32" to 7/16"
FEED.............022
S.F.M.............156
RESULTS.........Production up 25%—Scrap and rejects down.

A FULL LINE OF TALIDE TIPS IS AVAILABLE IN OVER 1000 SIZES, STYLES, SHAPES AND GRADES—TO MEET EVERY MACHINING REQUIREMENT



NEW IMPROVED CUTTING GRADES

An extensive 2-year research and development program has resulted in a completely new and improved series of Talide Metal grades for all-purpose machining. "Double-carbides" containing tantalum carbide and tungsten carbide have been perfected for cutting cast iron and non-ferrous alloys, and "triple-carbides" containing tantalum carbide, titanium carbide and tungsten carbide for machining steels.

Major improvements have been made in our rigidly controlled vacuum furnace technique. This, along with additional refinements in our process has resulted in the creation of a carbide having a new, unique grain structure possessing harder and tougher properties than previous grades.

Laboratory tests reveal that these new, improved grades have 25% greater strength and rigidity. Extensive field tests have proven that service life per grind is increased up to 50% over previous grades. **Metal Carbides Corporation, Youngstown 7, Ohio.**

Send for new 84-page Catalog No. 55-G.

METAL CARBIDES CORPORATION
MC
TALIDE®
YOUNGSTOWN 7, OHIO

HOT PRESSED AND SINTERED CARBIDES · VACUUM METALS
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P.O. Box 350.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, M. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathes, Turret
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-Tapping, Drive

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SEALS AND RETAINERS, Oil or Grease

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

SECOND-HAND MACHINERY, Etc.

Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.

SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAFTS

Jarvis Corp., Middletown Conn.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt, Co., Inc., 34 Exchange Pl., Jersey City 3, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS, Structural

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds, Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

SHEET METALS

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEET METAL MACHINES, Shrinking, Stretching, Forming & Flanging.

Engineering & Research Corp., Riverdale, Md.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS

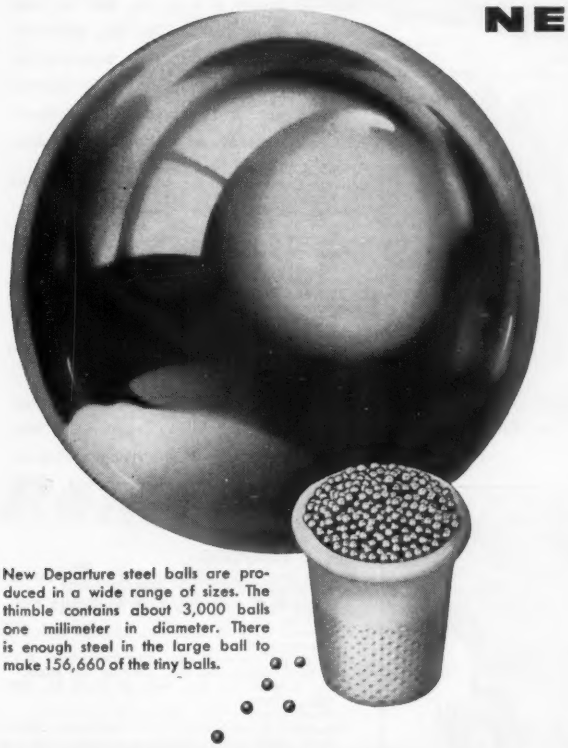
Laminated Shim Co., Inc., Glenbrook, Conn.

(Continued on page 352)

FACTS

about

NEW DEPARTURE
STEEL BALLS



New Departure steel balls are produced in a wide range of sizes. The thimble contains about 3,000 balls one millimeter in diameter. There is enough steel in the large ball to make 156,660 of the tiny balls.

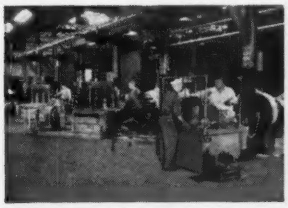
Available in any quantity to fit your specifications for grade, size and accuracy!

When industry wants steel balls of proven accuracy and dependability, it is only natural that they turn to New Departure, leading producer of ball bearings and therefore thoroughly experienced in the manufacture of precision balls. Today, New Departure provides industry with high-carbon chrome and stainless steel balls in a wide range of sizes and specifications.

New Departure balls are produced from the finest high-carbon chrome steel. AISI Type E51100 steel, specially made for New Departure, is heat-treated to achieve the proper hardness and toughness for maximum strength and life in the finished product. Stainless steel, AISI Type 440C, used by New Departure results in balls of much improved hardness and load-carrying ability.

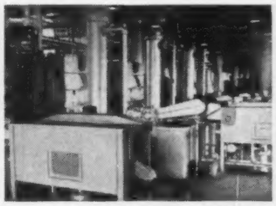
In addition to producing the finest steel balls available, New Departure will fill volume orders for balls of special materials such as high-nickel or cobalt-base alloys, tool steel and others.

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

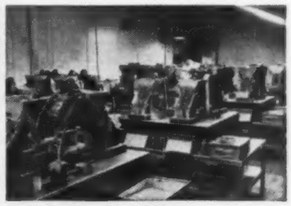


Steel ball wire is drawn through dies to assure uniform diameter and roundness.

Precise control of grain flow is obtained with these Ball Heading Machines.

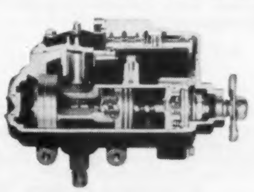


Balls are heat-treated, quenched in oil or water, then tempered in electric furnaces.

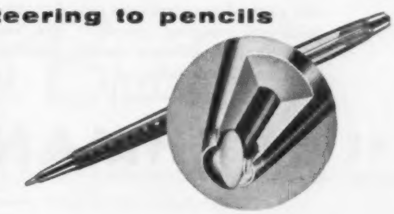


These gauges sort balls into lots according to required diameter limits.

Applications range from power steering to pencils



The unique advantages of New Departure steel balls are utilized in many applications ranging from heavy-duty bearings to the new liquid lead pencil. To accommodate these applications, New Departure steel balls are offered in sizes ranging from .025 inch to 1⅞ inches in diameter.



SLEEVES

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. C.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves, Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lipe-Railway Corp., 806 Emerson Ave., Syracuse, N. Y.
Mercury Engrg. Corp., Milwaukee, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Boston Gear Work, 320 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 So. Cicero Ave., Chicago 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

SPINDLES, Boring and Milling

Pope Mchry. Corp., Haverhill, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

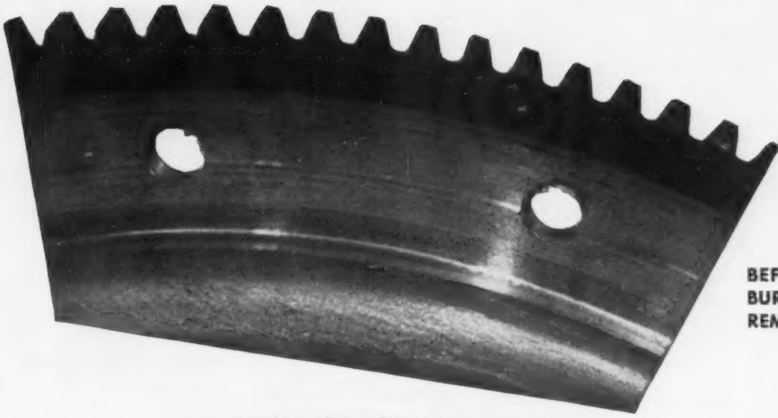
SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

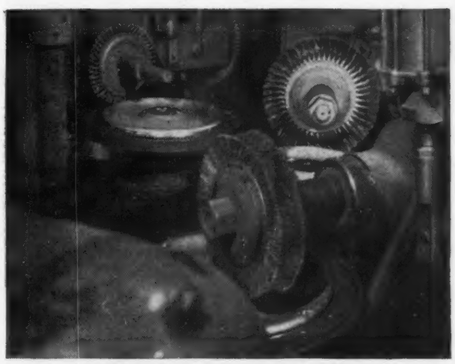
(Continued on page 354)



BEFORE
BURR
REMOVAL

AFTER
BURR REMOVAL

Removing burrs for trouble-free transmissions



One of many automatic brushing setups used by automotive manufacturers to finish transmission parts and other components.

BURRS left on automatic transmission parts can break loose in service, clog hydraulic lines and cause serious damage.

The two sections of a transmission cover shown above prove how thoroughly power brushing removes burrs and blends surface junctures . . . leaves the part smooth and clean.

Have an **O**sborn **B**rushing **A**nalysis made of your operations. It costs you nothing, but may save thousands of dollars in your finishing of parts. Write *The Osborn Manufacturing Company, Department D-36, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

For more information on products advertised, use Inquiry Card, page 231

SPROCKETS
Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, Sheet Metal
Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 Ave., Pittsburgh, Pa.
Wheeler-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburgh, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys teel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS
See Alloys, Steel

STEEL BARS
See Bars, Steel

STEEL STOCK GROUND FLA T
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

STONES, Oil or Sharpening
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS
Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire
Sesco, Inc., 8881 Central, Detroit 4, Mich.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

STUD SETTERS
Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.

SUB-PRESSES
Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE CHECKING EQUIPMENT
Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.
Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

SURFACE PLATES
See Plates, Surface

SWAGING MACHINES
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.

SWITCHES
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

TACHOMETERS
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

TANGS, Replaceable, Drill & Reamer
Nu-Tangs Inc., 1335 Bates St., Cincinnati, Ohio.

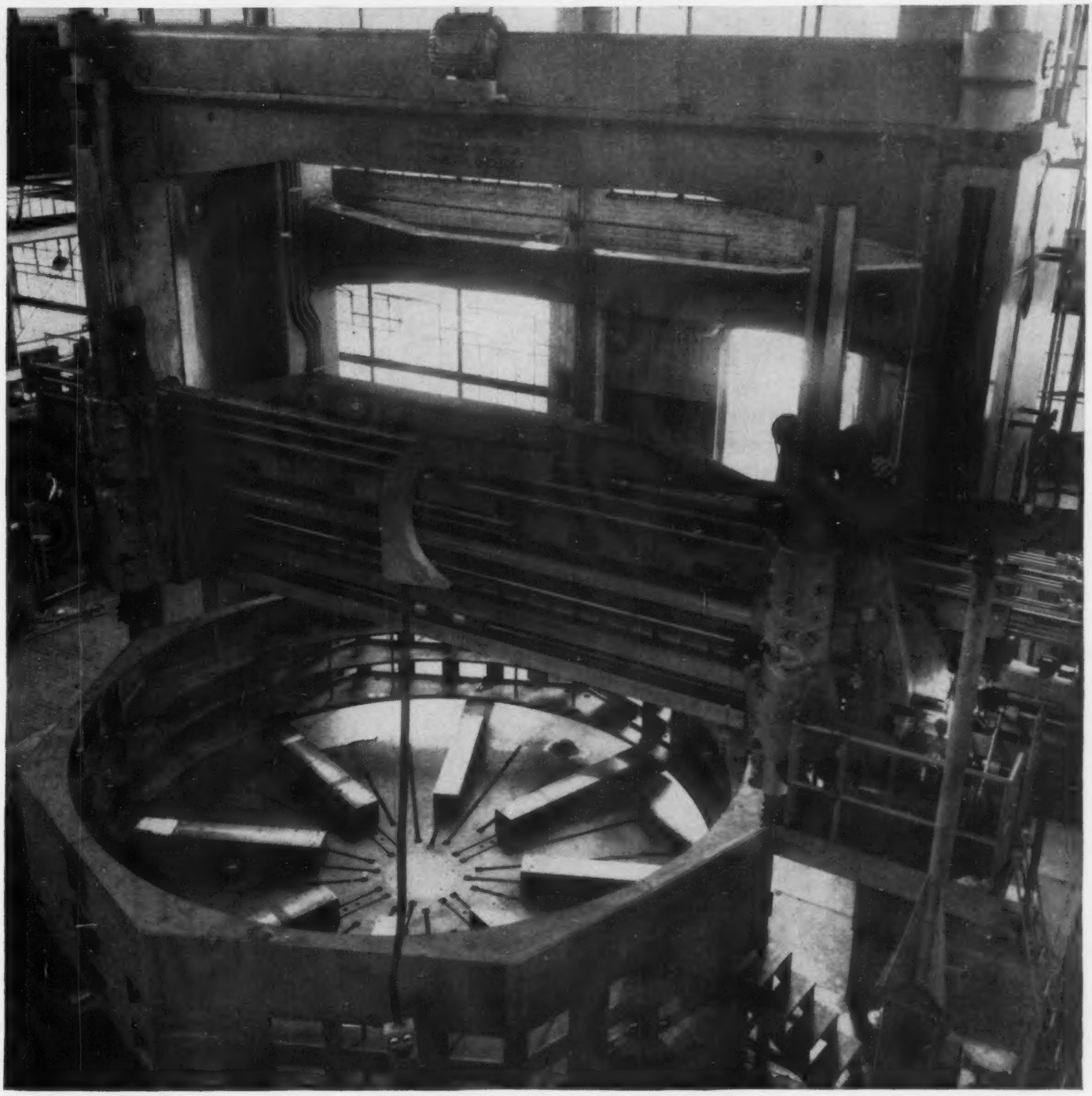
TAPER PINS, Standard
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jarvis Corp., Middletown, Conn.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 70, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., 1201 Camden Ave., S. W., Canton 6, Ohio.

(Continued on page 356)



For more information on products advertised, use Inquiry Card, page 231

Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia, 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Middletown, Conn.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

TESTING EQUIPMENT, Tension, Compression, Fatigue, etc.

Olsen Tinius, Testing Mch. Co., Willow Grove, Pa.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES

See Gages, Thread

THREAD GRINDING MACHINES

See Grinding Machines, Thread

THREAD MILLING MACHINES

Coulter, James, Machine Co., Bridgeport 5, Conn.
Lees-Bradner Co., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING HEADS

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

THREAD ROLLING MACHINES

Landis Machine Co., Waynesboro, Pa.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R.R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Sorp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., 20 N. Wacker Drive, Chicago 6, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy

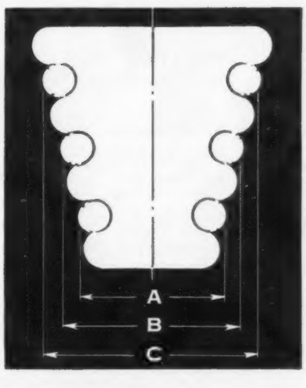
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1200 Woodward Heights Blvd., Ferndale, Mich.

(*Continued on page 358*)

New Taft-Peirce CompAIRator Air Gage

Measures and Computes

4 DIMENSIONS SIMULTANEOUSLY

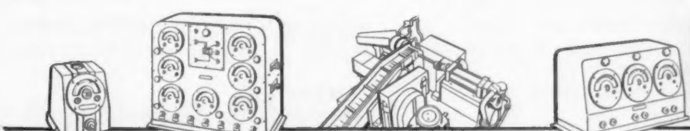


The CompAIRator above checks serrations in the root section of jet engine turbine blades. Does automatically and instantly what formerly took skilled hands many minutes to do.

Three of the air indicators measure thickness "over rolls" of the serrated sections. At the same time, a T-P Computing CompAIRator computes the difference between two of these dimensions and compares it to a standard value. If the variation is greater than plus or minus .001″ on the dial, the part is rejected. Most important of all, the serrations can be checked over their entire length.

Two different models of this gage have been built. One permits gaging with the part in the grinding fixture — thus eliminating many costly rejects. The other serves as a final inspection gage.

This unit is typical of the hundreds of Taft-Peirce CompAIRators now simplifying complicated gaging operations. For more information on this and many other items, send for your copy of the Taft-Peirce Handbook.



STANDARD AND SPECIAL COMPAIRATORS — AIR ELECTRIC COMPAIRATORS — AUTOMATIC SORTING MACHINE — COMPUTING COMPAIRATORS

T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

For more information on products advertised, use Inquiry Card, page 231

TOOL CONTROLS
Royal Design & Manufacturing, Inc., 4133 E. Ten Mile Rd., Centerline, Mich.

TOOL GRINDERS
See Grinding Machines for Sharpening, Turning and planing Tools

TOOL HOLDERS
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped
Ace Drill Corp., Adrian, Michigan.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
The Atrax Co., (Carbide) 240 Day St., Newington 11, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Newcomer Products, Latrobe, Pa.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
du Mont Corp., Greenfield, Mass.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Lathrobe, Pa.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TRANSFORMERS
General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBE MILLS
Abbey-Etna Co., 2444 Maplewood Ave., Toledo 10, Ohio.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBE TESTING AND EXPANDING MACHINE
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.

TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

TWIST DRILLS
See Drills, Twist

UNIT HEATERS
L. J. Wing Mfg. Co., Linden, N. J.

UNIVERSAL JOINTS
Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

VALVE CONTROLS
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Philadelphia Gear Works, (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines Ill.
Hunt, C. B., & Son., 1911 E. Pershing St., Salem, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lehigh Foundries, Inc., 1400 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VIBRATION INSULATION
American Felt Co., Glenville, Conn.

VISES, Machine
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

VISES, Pipe
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

VISES, Planer and Shaper
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elan and Garrard Aves., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

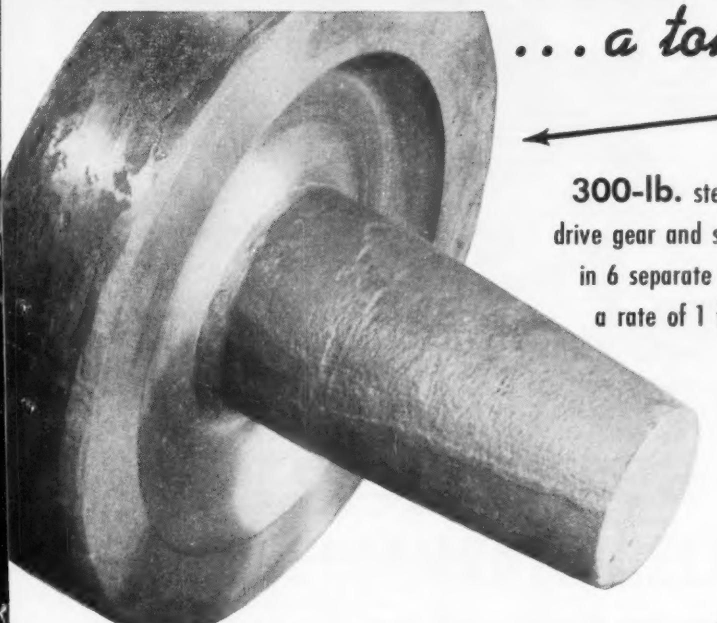
VOLTMETERS
General Electric Co., Schenectady, N. Y.

WASHERS, Lock
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

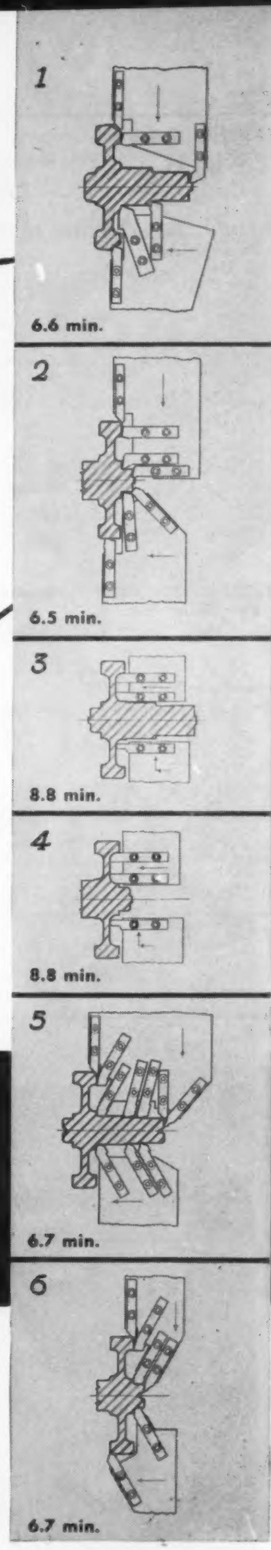
(Continued on page 359)

here's A JOB

... a tough one!

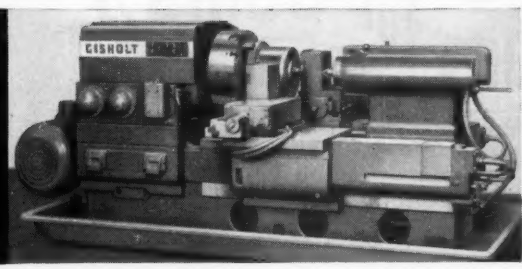


300-lb. steel forging for final drive gear and shaft—machined in 6 separate operations—at a rate of 1 finished piece per hour.



here's THE MACHINE

... that licks it!



GISHOLT
No. 24 Hydraulic
Automatic Lathe

Here's how Western Gear Works of Belmont, California, solved their problem:

With two longitudinal carriages and two transverse tool slides, the standard No. 24 machine has the flexibility to combine rapid traverse and feed in several directions. Hydraulic controls make it very simple to change setups.

Now, note how tooling costs were cut by using mounting plates instead of special slotted tool blocks. Large tool bit shanks are slotted, and thus are easily set before final bolting down. The complete riser blocks are quickly interchanged for various operations. And here, again, Gisholt's traditional power and rigidity show up on cuts that pull up to 80 h.p.

For low costs on tough jobs, think first of the Gisholt No. 24 Hydraulic Automatic Lathe. Write for literature.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

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represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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WASHERS, Spring
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

WELDING AND CUTTING EQUIPMENT Oxyacetylene
Linde Air Products Co., Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES
Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc
Federal Mch. & Welder Co., Warren, Ohio.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.
Federal Mch. & Welder Co., Warren, Ohio.

WELDING POSITIONER
duMont Corp., Greenfield, Mass.

WELDMENTS
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Mahon, R. C., Co., Detroit 34, Mich.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIPERS
Scott Paper Co., Chester, Pa.

WIRE
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co. Div.) 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WIRE NAIL MACHINERY
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
National Mchry. Co., Greenfield and Stanton Sts. Tiffin, Ohio.
Ryerson, Jos. T. & Son, Inc., 2588 W. 16th St., Chicago, 18, Ill.

WOODWORKING MACHINERY
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros & Co., 12th and Columbia Aves., Rockford, Ill.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

WORM DRIVES
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Philadelphia Gear Works, Erie Ave. and G. St., Philadelphia, Pa.

WRENCHES
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Detachable Socket
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

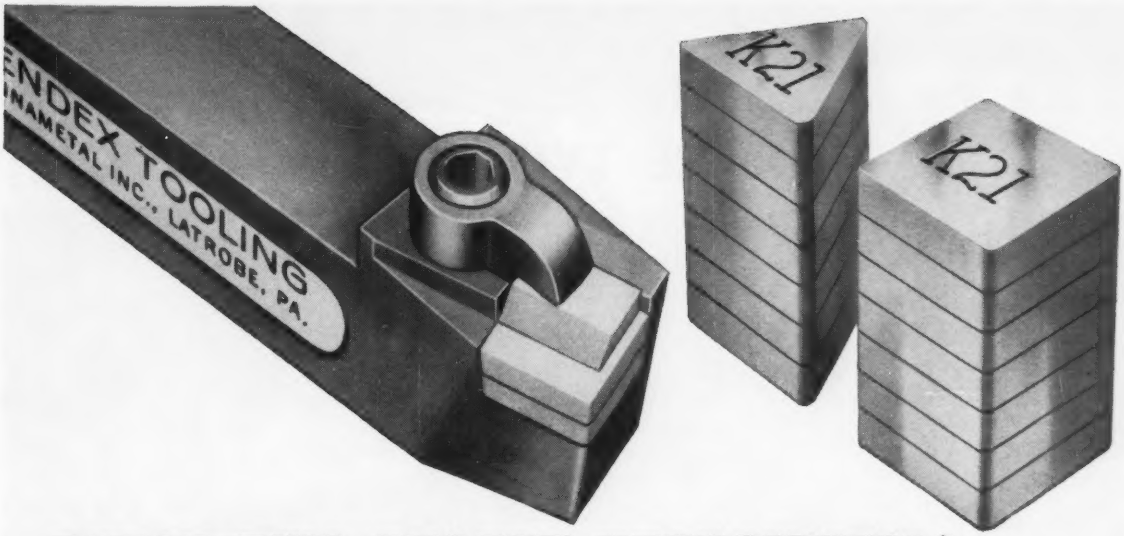
WRENCHES, Pipe
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

WRENCHES, Ratchet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Tap
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

WRENCHES, Torque Measuring
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

ZINC
New Jersey Zinc Co., 160 Front St., New York, N. Y.



THESE TWO RECENT KENNAMETAL* DEVELOPMENTS HELP TO MEET TODAY'S HIGH-SPEED PRODUCTION NEEDS

The profit advantages of today's high-speed automatic cycling machines for metal cutting are lost when tools wear rapidly—need frequent regrinding—or are cumbersome to index.

Kennametal recently introduced two new developments to help give you continuous machine performance, and to help step up profits in your steel-cutting operations. These developments are Kendex*† Button Tooling and Kennametal Grade K21.

Kendex "turnover" inserts, with replaceable Kennametal shims and new chip control system, double the number of cutting edges, eliminate all regrinding and index in seconds. These features help provide consistent tool performance and hold downtime to a minimum.

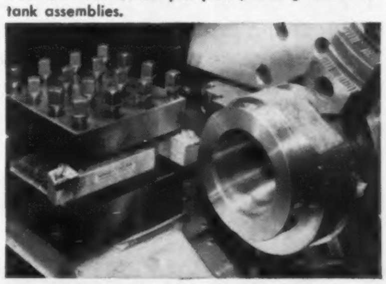
Grade K21 is the General Purpose steel-cutting carbide now outperforming all other medium grades in the carbide industry. Superior performance of K21 is due to exceptionally high edge strength, strong resistance to cratering and superior wear qualities. An extremely versatile grade, K21 can be applied to general steel-cutting, heavy roughing and finishing.

Kendex, in 17 styles and sizes; and K21, in popular blanks and inserts, are immediately available from stock. For their right application on your machining jobs, call a Kennametal Tool Engineer. He works exclusively with Kennametal . . . applying and servicing it. And be sure to ask for reports of Kendex and K21 repeat performances, job after job. KENNAMETAL INC., Latrobe, Pa.

*Registered Trademark †Patent applied for 5403

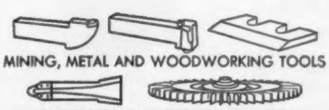
PROVED BEST—TEST AFTER TEST

Kendex Tooling with "turnover" inserts cuts tool cost from $1.20 to $0.09 per piece, turning SAE 4140 tank assemblies.



Grade K21—on interrupted cutting, roughed and finished 6 times as many pieces as other premium carbide.

Give your machines the tools they deserve . . . the BEST



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WEAR AND HEAT-RESISTANT PARTS

INDUSTRY AND KENNAMETAL

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ABRASION, CORROSION-RESISTANT PARTS

PERCUSSION AND IMPACT PARTS

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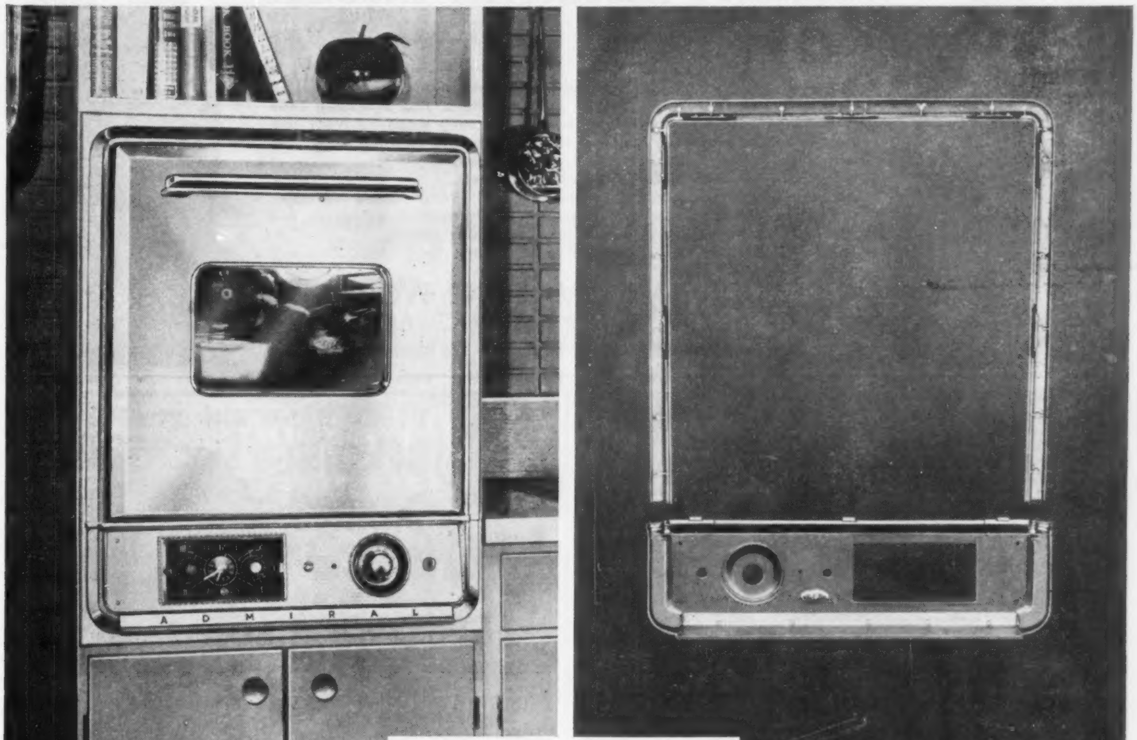
WHY ZINC RATES FIRST IN DIE CASTING • NUMBER 6 OF A SERIES



FRONT BACK

rigidity – as needed by **Admiral**

Built-in electric ranges and wall ovens are the latest products of the fertile minds of appliance designers. And the most efficient methods and materials are employed for each component of the new space-saving cooking units. The illustrated custom wall oven by Admiral, with its ZINC die cast inverted-U door frame and control panel, is an excellent case in point.

Obviously the frame and panel (back views above) could have been stamped from sheet metal, but not with the qualities and economies of these ZINC die castings. Stampings not only would lack the desired rigidity, but would not possess the following additional advantages obtained with die castings:

Send for your copy

1. No scrap loss
2. Integral mounting bosses for easy assembly
3. Dimensional accuracy for perfect fit of mating parts
4. Bold raised lettering on the control panel
5. Smooth as-cast surfaces which—being ZINC—take, and hold, beautiful chromium plating applied by commercial methods

Watch for other examples of ZINC die casting economies in our future advertisements. Send for our brochure and contact any commercial die caster for the answers to your particular production problems.

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FOR DIE CASTING ALLOYS

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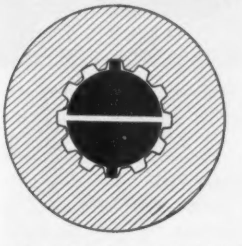
FOR GAGING SPLINE ROOTS

Both Odd and Even Tooth



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THE MARK OF DEPENDABILITY

The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment. Our prices are realistic with today's market and our quality of rebuilding is the same high standard—THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS.

PLANERS

P10 Coulter Crank Type Shaper-Planer, 1 head, m.d.
24"x24"x6' Ohio Standard Pattern Planer, m.d.
30"x30"x8' Cincinnati, belted m.d., 2 rail heads
30"x30"x10' Cincinnati, belted m.d., 2 heads
36"x36"x8' Cincinnati, m.d., 2 heads on rail
36"x36"x10' Betts, belted m.d., 2 heads on rail, 2 side heads
36"x36"x10' Gray, Extra Heavy Pattern, m.d., 2 heads on rail
36"x36"x10' Niles-Bement-Pond, belted m.d., 1 head on cross rail
36"x36"x12' Betts, m.d., 2 heads
36"x36"x12' Gray, 3 heads
36"x36"x20' Cincinnati, 2 heads, belt
36"x36"x20' Gray Extra Heavy, belt, 2 heads on rail
36" widened to 42"x36"x20' Cincinnati, m.d., 2 rail heads, 1 side head
36"x36"x30' Cincinnati, m.d., 4 heads
42"x42"x26' G. A. Gray, 2 heads, belted m.d.
48"x48"x12' Cincinnati, 4 heads
48"x48"x18' Niles-Bement-Pond, 2 heads, belt
48"x48"x18' Detrick & Harvey, 4 heads, reversing m.d.
48"x48"x28' Cincinnati, reversing m.d., 4 heads
56"x42"x14' Cincinnati, belted m.d., 2 heads

RAILROAD MACHINERY

No. 2 Niles-Bement-Pond Axle Lathe, m.d.
No. 3 Niles-Bement-Pond Axle Lathe, m.d.
48" Niles-Bement-Pond Car Wheel Borer, m.d.
52" Betts Car Wheel Borer
90" Niles Balanced Quartering & Crank Pin Turning Machine, latest
90" Putnam Driving Wheel Lathe, m.d.
90" Niles Journal Lathe, including 2 inside journal turrets and 3½" spindle double quartering attachment, m.d.
90" Niles Driving Wheel Lathe, m.d., latest
Niles-Bement-Pond Quartering Machine, m.d., new
No. 3 Betts Bridgeford Axle Lathe, m.d.
Betts-Bridgeford Combination Journal Truing & Axle Lathe, 3 carriages

SHAPERS

No. 14 Cochran Bly Vertical Shaper, m.d.
16" Gould & Eberhardt Shaper, m.d.
24" Cincinnati Shaper, Universal Table
24" Potter & Johnston, cone
32" Morton Draw-Cut, m.d., late
32" Ohio Shaper, m.d.
36" Morton Draw-Cut, m.d., late
36" Rockford Universal Openside Shaper Planer, m.d.
24" Columbia Back Geared Crank Shaper, m.d.
32" Ohio Shaper
38" Morton Draw Cut Shaper
24" Gould & Eberhardt, m.d.

TAPPERS

No. 1 Haskins, pneumatic control, type 1 CAP
No. 2 Haskins, pneumatic control, type 2 CAP
No. 3 Haskins, pneumatic control, type 3 CAP
Acme Semi-Automatic 6 spindle, 1½", arranged for m.d.
No. 3 C Haskins, pneumatic control, type 3 CAM, m.d.
2 spindle Haskins, pneumatic control, m.d.
No. 22 Murchey, 6 to 28 pitch
3 way Natco Tapper & Drill

SHEET METAL MACHINERY

No. 3 Ryerson Rotary Bevel Shear, m.d.
No. 2 Libert Nibbler, 28" throat
No. 3—⅝" capacity Gray Sheet Metal Cutter, m.d.
12'x⅜" cap. Dreis & Krump Leaf Brake, m.d.
Size 848 Model 0 Parker Tube Bender, hand-operated
No. 6 Niles Pyramid Type Plate Bending Roll, m.d.
No. 11-SBC Buffalo Armor Plate Bar Cutter, m.d.
No. 47 Buffalo Double End Shear and Bar Cutter, m.d.
Model 1236 Libert High Speed Nibbler Type Shear, m.d.

TURRET LATHES AND SCREW MACHINES

No. 601 W. D. Oster Geared Head Rapiduction, m.d. inleg, chucking
No. 1 Warner & Swasey "Electric", m.d., bar
No. 1A Warner & Swasey, m.d., 1940
No. 1L Gisholt Universal, m.d., 1943
No. 1, 2 Cincinnati Acme Full Universal, m.d.
No. 2A Warner & Swasey, m.d., preselector head, late
No. 2F Foster Fastermatic, m.d., Timken
No. 2G Morey, 1" cap., bar
No. 2L Gisholt Universal, m.d., latest type, 1945
No. 3 Cincinnati Acme Full Universal, m.d., chucking
No. 3 Foster Geared Head, m.d.
No. 3A Warner & Swasey, m.d., 1942
No. 3F Foster Fastermatic, m.d., Timken
No. 4 Warner & Swasey, cone, bar and chucking types
No. 4A Warner & Swasey, Universal, m.d., chucking, 1939
No. 4 Gisholt Universal, m.d.
No. 4L Gisholt Universal, m.d., 1943
No. 4FU Foster Fastermatic, m.d., latest, 1945
No. 5 Gisholt Ram Type, preselector head, m.d.
No. 5 Gisholt Universal, m.d., late type, 1942
⅝" Pratt & Whitney Hand Screw Machine, cone, bar
2½x24", 3½x32", 4x34" Jones & Lamson Geared Head, m.d., bar and chucking
18" Libby Type A, m.d., chucking
20" Acme, s.p.d., bar
20" Dreses, arranged for factory m.d.
26" Libby Type C, m.d., chucking

The above is only a partial listing

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GRINDERS, CYLINDRICAL, 6" x 18" Landis, 30° Head, New 1941.
GRINDERS, CYLINDRICAL, 10" x 18" Cincinnati ER plain hyd., 1946.
GRINDERS, CYLINDRICAL, 16" x 96" Landis type B, 48" gap, new 1941.
GRINDERS, Cyl., Universal, 12" x 48" Norton hydraulic, with internal attachments, new 1941.
GRINDERS, CYLINDRICAL, 6" x 30" Cincinnati E A Filmatic plunge cut (2) 1942-1943.
GRINDERS, SURFACE, 14" x 36" Pratt & Whitney vert spdl., 1942.
GRINDERS, SURFACE, 43" No. 16A2 Blanchard rotary, new 1947.
GRINDERS, SURFACE, 72" No. 72 Hanchett rotary, new 1946.
LATHES, ENGINE, 14" x 6' bed Hendey toolroom, Timken, 194C.
LATHES, ENGINE, 24" x 20' bed Leblond H.D. G.H., older.
LATHES, ENGINE, 20" x 67" Axelson Heavy Duty Model, new 1941.
LATHES, GAP 20"/38" x 60" cc Nebel gap lathe, new 1941.
LATHES, TURRET, 36" and 42" Bullard New Era vertical.
MILL, No. 3-H Kearney & Trecker plain, horizontal, new 1942.
MILL, No. 4 Cincinnati Hi power plain horizontal.
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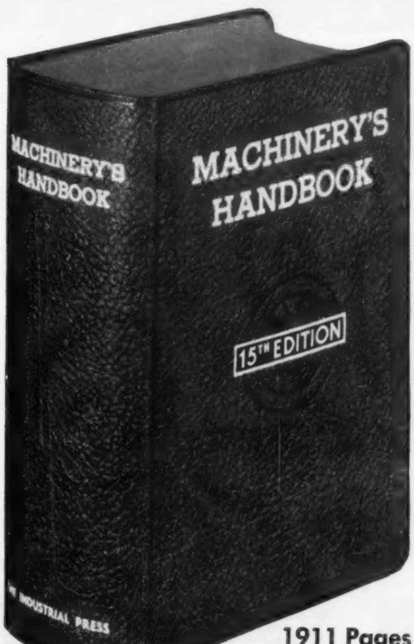

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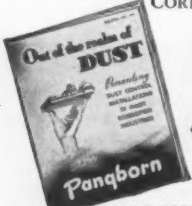

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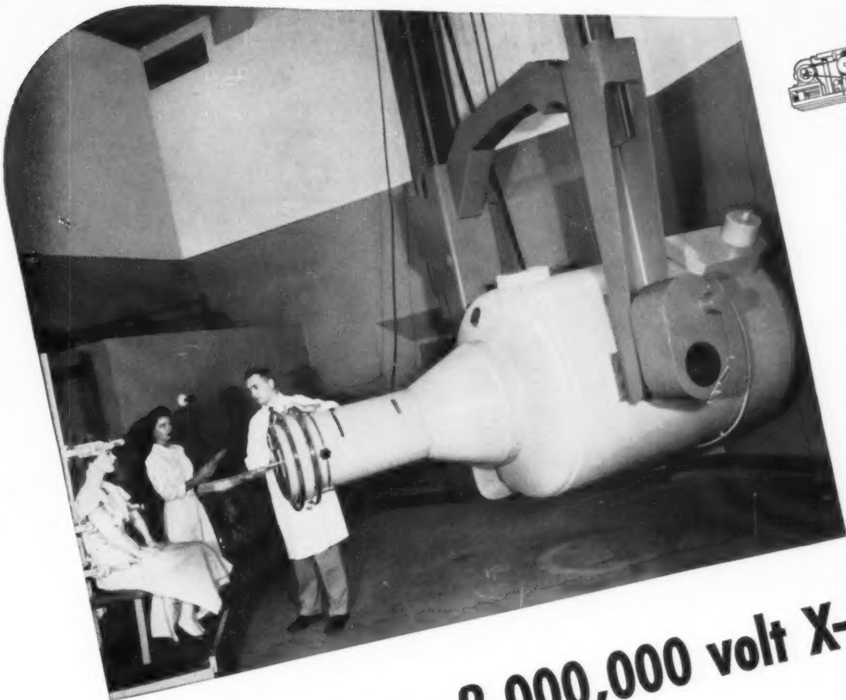

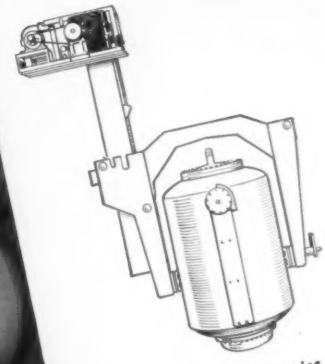

Close-up of CLEVELAND Series 63F Double Reduction Worm Gear Speed Reducer used to raise and lower this G.E. 2-million volt X-Ray Tube Head.

CLEVELAND positions 2,000,000 volt X-ray machine

QUITE an X-ray machine, this—built by General Electric to serve the New England Deaconess Hospital in Boston, Mass. Quite a job, too, to raise and lower its head—it's heavy, it's delicate, and it has to be positioned accurately. That's why Cleveland was specified to transfer the speed of the motor into slow, smooth and dependable power.

For, with Cleveland worm gear speed reducers, smooth torque flow is assured by virtue of the sliding action of worm on gear. Constant angular velocity assures positive control. Precision matching of case-hardened steel worms to nickel-bronze gears insures 100% dependability.

Experience has demonstrated that a Cleveland actually improves with use. Even when operating under continued severe overloads, danger of sudden failure is remote. Thousands of Clevelands, in fact, operate for the life of driven machines.

Why not get the complete Cleveland story by writing for Catalog 400 today! The Cleveland Worm & Gear Company, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

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